

Physical Size	Standard Sign DIN 1301	Equivalent
Length (meter)	m	1 m = 1 000 mm 1 km = 1 000 m 1 μ m = 0.001 mm
Area (square meter)	sq. m	1 sq. m = 10 ⁶ sq. mm 1 sq. dm = 0.01 sq. cm
Volume (cubic meter)	cu. m	1 cu. m = 10 ⁶ cu. cm 1 cu. dm = 0.001 cu. m
Angle (degree, radian)	°, rad	1 rad = 1 $\frac{\text{m. arc}}{\text{m. radius}}$ \approx 57 [°] 1 [°] = 37/180 rad
Mass (kilogram)	kg	1 kg = 1 000 g 1 g = 1 000 mg 1 t = 1 Mg = 1 000 kg
Density (kilogram per cubic meter)	kg/cu. m	1 kg/cu. m = 0.001 kg/cu. dm 1 kg/cu. dm = 1 kg/l
Time (second)	s	1 min = 60 s 1 h = 60 min
Frequency	Hz	1 Hz = 1/s
Rotary frequency (speed)	1/s, 1/min	1 U/min = 1/min = 1 rpm 1/min = 1/60 s
Velocity	m/s	1 m/s = 3.6 km/h
Acceleration	m/s ²	
Force (newton)	N	1 N = 1 kgm/s ² 1 kp = 9.81 N
Pressure (pascal)	Pa	1 at = 1 kp/sq. cm = 0.981 bar = 98 066.5 Pa 1 m WS = 9 806.65 Pa = 9 806.65 N/sq. m 1 Torr = 1 333 224 mbar 1 mm Hg = 133.322 Pa = 133.322 N/sq. m 1 N/sq. m = 1 Pa 1 kg/sq. mm = 9.81 N/sq. mm

Physical Size	Standard Sign DIN 1301	Equivalent	
Mechanical tension	N/sq. mm	1 N/sq. m = 1 Pa 1 kp/sq. mm = 9.81 N/sq. mm	
Energy, work, heat quantity (joule)	J	1 J = 1 Nm 1 kWh = 3.6 MJ 1 kpm = 9.81 1 cal = 4.1868 J	
Torque (newton meter)	Nm	1 kpm = 9.81 Nm	
Power (watt)	W	1 kW = 1 000 W 1 W = 1 Nm/s = 1 J/s 1 PS = 736 W = 75 kpm/s	
Viscosity	dynamic	Pas	1 Pas = 1 Ns/sq. m 1 P = 0.1 Pas = 1 g/cms
	Kinematic	sq. m/s	1 sq. m/s = 1 Pas (cu. m/kg) 1 St = 1 sq. cm/s = 0.0001 sq. m/s
Temperature (Celsius) (Kelvin)	°C K	0°C = 273.15 K 1 grad = 1°K = 1 K = 1°C (temperature difference)	
Electric current (ampere)	A	1 mA = 0.001 A 1 kA = 1 000 A	
Electric voltage (volt)	V	1 V = 1 W/A 1 mV = 0.001 V	
Electric resistance (ohm)	Ω	1 Ω = 1 V/A = 1/S	
Magnetic flow (weber)	Wb	1 Wb = 1 Vs 1 M = 10 ⁻⁸ Wb	
Magnetic flow density (tesla)	T	1 T = 1 Wb/sq. m	
Magnetic field strength	A/m	1 A/m = 1 N/Wb	
Light strength (candela)	cd		

ENGINE M 10

B 18

11 - 10

- a) 316
b) 316i
c) 316i Catalyst

11 00 ... Engine in General

Bore	mm	88
Stroke	mm	71
Effective displacement	cm ³	1766
Compression ratio		a) 9.5 : 1 b) 9.5 : 1 c) 9.2 : 1
Power (to DIN 70020) / at engine speed	kW/ rpm	a) 66/5500 b) 77/5000 c) 75/5800
Max. top speed	rpm	6200
Max. constant speed	rpm	6000
Max. torque / at engine speed	Nm/ rpm	a) 140/4000 b) 145/4500 c) 140/4500
Compression (approx. same value for all cylinders)	bar	at least 10 ... 11
Idling speed	rpm	850 ± 50

11 00 ... Engine Oil Consumption

Oil consumption can be measured for the first time after the car has been driven approximately 7,500 km. Oil consumption will be stable only after this distance. Measuring oil consumption requires that the engine does not leak.

Precise consumption can be determined by weighing. Drain engine oil having operating temperature. Allow 5 minutes drip time. Weigh and pour in specified amount of new engine oil. Drive car 1,000 km. Drain engine oil at operating temperature and weigh. Allow 5 minutes drip time. Engine oil density at room temperature is approx. 0.9 km/cubic dm (dm^3).

Max. permissible oil consumption when measured* by weighing: 0.07 ltr. / 100 km.

Example:

Poured in oil	—	drained oil	=	consumed oil.
4,500 g	—	3,600 g	=	900 g

$900 : \text{density } 0.9 = 1,000 \text{ cm}^3 = 1 \text{ liter per } 1,000 \text{ kilometers}$

Possible Causes for Excessive Oil Consumption:

1. Running-in process not completed.
2. Seals for valve stems damaged.
3. Pistons seized.
4. Piston rings installed wrong, broken or worn.
5. Excessive running clearance between valve stem and valve guide.

* Refer to Group 11 of Operating Fluids

11 11 — Crankcase

Cylinders		
Bore dia.	mm (in.)	89.00 ± 0.01 (3.5039 \pm 0.0004)
Intermediate size	mm (in.)	89.08 ± 0.01 (3.5071 \pm 0.0004)
1st oversize	mm (in.)	89.25 ± 0.01 (3.5138 \pm 0.0004)
2nd oversize	mm (in.)	89.50 ± 0.01 (3.5236 \pm 0.0004)
Surface finish	Rz (μ)	3 to 4
Max. cyl. bore out-of-true	mm (in.)	0.01 (0.0004)
Max. cyl. bore circularity	mm (in.)	0.01 (0.0004)

ENGINE M 10

11 – 13

B 18

11 12 ... Cylinder Head

Cylinder head height
(machining limit)

mm (in.)

128.6 (5.063)

11 12 ... Valve Guide

Valve guide dia. — bore dia.

Standard size

mm (in.)

14.0 u6 — 14.0 M7 (0.5512)

Oversize 1

mm (in.)

14.1 u6 — 14.1 M7 (0.5551)

Oversize 2

mm (in.)

14.2 u6 — 14.2 M7 (0.5590)

Oversize 3

mm (in.)

14.3 u6 — 14.3 M7 (0.5630)

Total length

mm (in.)

50.6 (1.998)

Valve guide inside diameter
(installed)

Standard size

mm (in.)

8.0 H7 (0.3150)

Oversize 1

mm (in.)

8.1 H7 (0.3189)

Oversize 2

mm (in.)

8.2 H7 (0.3228)

Installing temperature

Cylinder head

°C (°F)

+ 50 (+ 120)

Valve guide

°C (°F)

– 150 (– 240)

Valve guide protrusion

mm (in.)

15 (0.590)

11 12 .. Valve Seat Inserts

Valve seat insert dia. - bore dia.
(distance "D")

Intake

Standard size	mm (in.)	47.15 g6 (1.8563) - 47.00 H7 (1.8504)
Oversize 0.2 mm (0.0079")	mm (in.)	47.35 g6 (1.8642) - 47.20 H7 (1.8583)
Oversize 0.4 mm (0.0157")	mm (in.)	47.55 g6 (1.8720) - 47.40 H7 (1.8661)

Exhaust

Standard size	mm (in.)	40.15 g6 (1.5807) - 40.00 H7 (1.5748)
Oversize 0.2 mm (0.0079")	mm (in.)	40.35 g6 (1.5886) - 40.20 H7 (1.5827)
Oversize 0.4 mm (0.0157")	mm (in.)	40.55 g6 (1.5964) - 40.40 H7 (1.5905)

Valve seat insert height - bore depth
(distance "H")

Standard size	mm (in.)	7.2 h11 (0.2835) - 7.35 H11 (0.2894)
Oversize 0.2 mm (0.0079")	mm (in.)	-
Oversize 0.4 mm (0.0157")	mm (in.)	-

Installing temperature

Valve seat insert	°C (°F)	- 150 (- 240)
Cylinder head	°C (°F)	+ 50 (+ 120)

ENGINE M 10

B 18

11 - 15

11 12 ... Valve Seats

Valve seat angle

°

45

Correction angles

°

15 / 75

Valve seat width
(distance "B")

Intake

mm (in.)

1.3 to 2.0 (0.051 to 0.079)

Exhaust

mm (in.)

1.3 to 2.0 (0.051 to 0.079)

Valve seat diameter
(distance "M")

Intake

mm (in.)

44.6 (1.756)

Exhaust

mm (in.)

38.6 (1.441)

11 21 ... Crankshaft and Bearings

- Double Classification -

Ground sizes of main bearing journals

Standard size	red	mm (in.)	55.00 \pm $\frac{0.018}{0.020}$ (2.1653 \pm $\frac{0.0004}{0.0008}$)
	blue	mm (in.)	55.00 \pm $\frac{0.020}{0.025}$ (2.1653 \pm $\frac{0.0008}{0.0011}$)
Undersize 1	red	mm (in.)	54.75 \pm $\frac{0.018}{0.020}$ (2.1556 \pm $\frac{0.0004}{0.0008}$)
	blue	mm (in.)	54.75 \pm $\frac{0.020}{0.025}$ (2.1556 \pm $\frac{0.0008}{0.0011}$)
Undersize 2	red	mm (in.)	54.50 \pm $\frac{0.018}{0.020}$ (2.1457 \pm $\frac{0.0004}{0.0008}$)
	blue	mm (in.)	54.50 \pm $\frac{0.020}{0.025}$ (2.1457 \pm $\frac{0.0008}{0.0011}$)
Undersize 3	red	mm (in.)	54.25 \pm $\frac{0.018}{0.020}$ (2.1358 \pm $\frac{0.0004}{0.0008}$)
	blue	mm (in.)	54.25 \pm $\frac{0.020}{0.025}$ (2.1358 \pm $\frac{0.0008}{0.0011}$)
Radial crankshaft bearing play			mm (in.)
			0.03 to 0.07 (0.0012 to 0.0027)

ENGINE M 10

B 18

11 - 17

11 21 ... Crankshaft and Bearings

Ground sizes of crankshaft thrust bearing

Standard size	mm (in.)	30.0 ± 0.023 (1.1811 ± 0.0021)
Over size 1	mm (in.)	30.2 ± 0.024 (1.1890 ± 0.0023)
Over size 2	mm (in.)	30.4 ± 0.024 (1.1968 ± 0.0025)
Over size 3	mm (in.)	30.6 ± 0.024 (1.2047 ± 0.0025)
Axial crankshaft play	mm (in.)	0.085 to 0.174 (0.0033 to 0.0068)

ENGINE M 10

8 18

11 - 18

11 21 Crankshaft and Bearings

Ground sizes of conrod bearing journals

Standard size	mm (in.)	48 00 - $\frac{0.002}{0.025}$ (1.8898 - $\frac{0.002}{0.0098}$)
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Undersize 1	mm (in.)	47 75 - $\frac{0.002}{0.025}$ (1.8799 - $\frac{0.002}{0.0098}$)
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Undersize 2	mm (in.)	47 50 - $\frac{0.002}{0.025}$ (1.8701 - $\frac{0.002}{0.0098}$)
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Radial conrod bearing play	mm (in.)	0.03 to 0.07 (0.0012 to 0.0027)
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- Double Classification -

Ground sizes of conrod bearing journals

Standard size	mm (in.)	47.975 to 47.991 (1.8888 to 1.8894)
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Undersize 1 0.25 mm (0.0098")	mm (in.)	47.725 to 47.741 (1.8789 to 1.8796)
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Undersize 2 0.50 mm (0.0197")	mm (in.)	47.475 to 47.491 (1.8681 to 1.8687)
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Undersize 3 0.75 mm (0.0295")	mm (in.)	47.225 to 47.241 (1.8582 to 1.8588)
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Radial conrod bearing play	mm (in.)	0.020 to 0.055 (0.0008 to 0.0022)
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ENGINE M 10

B 10

11 – 19

11.21 Crankshaft and Bearings

Max. imbalance of crankshaft
(dynamic without flywheel)

gcm

50

Measuring planes

Center of bearing journals

Take-up

Ends of crankshaft in points

Balancing speed

rpm

500

Max. runout on center main
bearing journal (crankshaft
running on outer bearing
journals)

mm (in.)

0.1 (0.004)

Crankshaft throw

mm (in.)

71 ± 0.1 (2.795 ± 0.004)

Max. surface finish of bearing
journals

Rt (μ)

1.5 (0.059)

ENGINE M 10

B 18

11 – 20

11 22 ... Flywheel

Max. axial runout measured
on outside diameter

mm (in)

0.1 (0.004)

Minimum flywheel thickness
(distance "A")

mm (in)

23.6 \pm 0.1 (0.929 \pm 0.004)

ENGINE M 10

11 - 21

B 18

11 24 . Connecting Rods and Bearings

Big conrod end bore dia.	mm (in.)	52.000 to 52.010 (2.0472 to 2.0476)
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- Double Classification -

Big conrod end bore dia. Red	mm (in.)	52.000 to 52.008 (2.0471 to 2.0475)
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Blue	mm (in.)	52.009 to 52.016 (2.0476 to 2.0479)
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Conrod bushing - outside dia.	mm (in.)	24.060 to 24.100 (0.9472 to 0.9488)
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inside dia.	mm (in.)	22 $\begin{smallmatrix} + 0.003 \\ - 0.008 \end{smallmatrix}$ (0.8661 $\begin{smallmatrix} + 0.0001 \\ - 0.0003 \end{smallmatrix}$)
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Max. deviation in parallel of conrod bores with bearing shells at d stance of 150 mm (5.905")	mm (in.)	0.04 (0.0016)
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Max. distortion to one side	0° 30'
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Max. deviation in weight of connecting rods in one engine (without bearing shells)	g	± 4
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Big end	g	± 2
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Small end	g	+ 2
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11.25 Pistons

Pistons and pins are matched — only replace together as pairs.

Weight class (die stamped or engraved)

max. weight difference of
individual pistons 10 grams
+ or —

Identification on piston

piston diameter, arrow for
direction of installation
and compression ratio

Piston dia. (checkpoint "A")

Standard size

mm (in.)

88.97 (3.503)

Intermediate size

mm (in.)

89.05 (3.506)

Oversize 1

mm (in.)

89.22 (3.512)

Oversize 2

mm (in.)

89.47 (3.522)

Piston running clearance

mm (in.)

0.02 to 0.05 (0.0008 to 0.0020)

Max. total wear clearance between
pistons and cylinders
(used engine)

mm (in.)

0.15 (0.006)

ENGINE M 10

B 18

11 – 23

11.25 Piston Rings

Groove 1 (plain compression ring)		
End clearance	mm (in.)	0.3 to 0.7 (0.012 to 0.027)
Side clearance	mm (in.)	0.06 to 0.09 (0.0024 to 0.0035)
Groove 2 (tapered edge compression ring)		
End clearance	mm (in.)	0.2 to 0.4 (0.008 to 0.016)
Side clearance	mm (in.)	0.03 to 0.072 (0.0012 to 0.0028)
Groove 3 (bevelled edge oil scraper ring)		
End clearance	mm (in.)	0.25 to 0.5 (0.010 to 0.020)
Side clearance	mm (in.)	0.02 to 0.06 (0.0008 to 0.0024)

ENGINE M 10

11 – 24

B 18

11 31 . Camshaft

Drive single roller chain

11 31 Chain Tensioner Piston

Piston length mm (in.) 62 (2.441)

Relaxed spring length mm (in.) 165.5 (6.122)

11 33 Rocker Arms

Radial clearance mm (in.) 0.016 to 0.052 (0.0006 to 0.0020)

11 34 . Valves

Valve clearance for intake and exhaust valves

At max. 35° C (95° F) coolant temperature

mm (in.)

0.20 (0.008)

At operating temperature
(thermostat activated)

mm (in.)

0.25 (0.010)

Min. valve head edge thickness

— machining limit (distance "A")

Intake

mm (in.)

1.3 (0.051)

Exhaust

mm (in.)

2.0 (0.079)

Valve head dia. (distance "T")

Intake

mm (in.)

46 (1.811)

Exhaust

mm (in.)

38 (1.496)

Valve stem dia. (distance "S")

Standard size

mm (in.)

8.0 (0.315)

Oversize 1

mm (in.)

8.1 (0.319)

Oversize 2

mm (in.)

8.2 (0.323)

Max. wear clearance between

valve stem and valve guide

(tol. clearance "K")

mm (in.)

0.8 (0.031)

ENGINE M 10

B 18

11 25

11.40 Oil Supply

Lubricating system

forced circulation with pressure
control valve in filtered oil circuit

Oil grade

see Service Information of Gr. 00

Total oil volume ltr (US/Imp pts)

4.0 (8.4 / 7.0)

Oil volume in filter ltr (US/Imp pts)

0.25 (0.5 / 0.4)

Oil consumption in liters (US/Imp. pints)
per 100 kilometers (60 miles)
(see page 00-3)

max. 0.15 (0.32 / 0.26)

ENGINE M 10

B 18

11 ~ 27

11.41 .. Oil Pump

Design		Eaton
Oil pressure at idle speed	bar (psi)	0.5 to 2.0 (7 to 28)
Oil pressure at top speed	bar (psi)	4.0 to 6.0 (57 to 85)
Radial clearance between outer rotor and pump body	mm (in.)	0.1 to 0.15 (0.004 to 0.006)
Axial clearance between rotor and pump body	mm (in.)	0.04 to 0.1 (0.0016 to 0.0039)
Gap between inner and outer rotors	mm (in.)	0.12 to 0.20 (0.005 to 0.008)
Relaxed spring length	mm (in.)	68 (2.677)
Distance between flange and inner rotor	mm (in.)	42.7 (1.681)

ENGINE M 10		8 10	
11 – 20			
11 42 ... Oil Filter			
Full flow oil filter bypass valve opening pressure	bar (psi)	2.5 (35)	
11 51 ... Water Pump			
Clearance between cover in body and impeller	mm (in)	0.8 to 1.2 (0.031 to 0.047)	
Distance from upper edge of flange to end of shaft	mm (in)	3.0 to 3.5 (0.118 to 0.138)	

ENGINE M 10

11 – 29

Ø 10

11 52 . Fan Clutch

Design		temperature and speed controlled vaco fan clutch
Switching-on temperature	°C (°F)	82 ± 4 (180 ± 7)
Switching-off temperature	°C (°F)	≥ 80 (140)
Fan dia./no of blades	mm (in.)	420 (16 5/32) / 8
Fan speed at 3600 rpm engine speed (clutch operated)	rpm	2500 ± 100
Axial play of rotor	mm (in.)	max. 0.4 (0 016)
Radial play of rotor	mm (in.)	0.5 (0 020)
11 53 Thermostat (Coolant)		
Opening temperature (stamped in thermostat)	°C (°F)	approx. 89 (175)

ENGINE M 20

11 - 30

B 20a) 320l, 520l
b) 320l, 520l
Catalyst**B 25**a) 325l, 525l
b) 320l, 525l
Catalyst**11 00 ... Engine in General**

Bore	mm	80	84
Stroke	mm	66	75
Effective displacement	cm ³	1090	1494
Compression ratio		a) 9.4 : 1 b) 8.8 : 1	a) 9.4 : 1 b) 8.8 : 1
Power (to DIN 70020) / at engine speed	KW/ rpm	95/5000	a) 126/5800 b) 125/5800
Max. top speed	rpm	6200	6200
Max. constant speed	rpm	6000	6000
Max. torque / at engine speed	Nm/ rpm	a) 174/4000 b) 164/4300	a) 226/4000 b) 222/4300
Compression (approx. same value for all cylinders)	bar	at least 10 ... 11	at least 10 ... 11
Idling speed	rpm	750 ± 40	750 ± 40

11 00 . Engine Oil Consumption

DETERMINING OIL CONSUMPTION

Oil consumption can be measured for the first time after the car has been driven approximately 7,500 km. Oil consumption will be stable only after this distance. Measuring oil consumption requires that the engine does not leak.

Precise consumption can be determined by weighing. Drain engine oil having operating temperature. Allow 5 minutes drip time. Weigh and pour in specified amount of new engine oil. Drive car 1,000 km. Drain engine oil at operating temperature and weigh. Allow 5 minutes drip time. Engine oil density at room temperature is approx. 0.9 km/cubic dm (dm^3).

Max. permissible oil consumption when measured* by weighing: 0.07 lit. / 100 km.

Example:

Poured in oil	—	drained oil	=	consumed oil
4,500 g	—	3,600 g	=	900 g

$900 : \text{density } 0.9 = 1,000 \text{ cm}^3 = 1 \text{ liter per } 1,000 \text{ kilometers}$

Possible Causes for Excessive Oil Consumption.

1. Running-in process not completed.
2. Seats for valve stems damaged.
3. Pistons seized.
4. Piston rings installed wrong, broken or worn.
5. Excessive running clearance between valve stem and valve guide.

* Refer to Group 11 of Operating Fluids

ENGINE M 20

B 20

B 25

11 - 32

11.11 Crankcase

Cylinder bore diameter			
Standard size	mm (in.)	80.00 ± 0.01 (3.1496 \pm 0.0004)	84.00 ± 0.01 (3.3071 \pm 0.0004)
Intermediate size	mm (in.)	80.08 ± 0.01 (3.1527 \pm 0.0004)	84.08 ± 0.01 (3.3102 \pm 0.0004)
Oversize 1	mm (in.)	80.25 ± 0.01 (3.1594 \pm 0.0004)	84.25 ± 0.01 (3.3189 \pm 0.0004)
Oversize 2	mm (in.)	80.50 ± 0.01 (3.1693 \pm 0.0004)	84.50 ± 0.01 (3.3267 \pm 0.0004)
Surface finish	Rt (μ)	3 to 4	
Max. cyl. bore out-of-round	mm (in.)	0.02 (0.0008)	0.03 (0.0012)
Max. cyl. bore concentricity	mm (in.)	0.02 (0.0008)	

ENGINE M 20	B 20	B 25
11 - 33		

11 12 Cylinder Head

Cylinder head height (machining limit)	mm (in.)	124.7 (4.909)
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11 12 Valve Guides

Valve guide dia. - bore dia		
Standard size	mm (in.)	13.2 u6 - 13.2 M7 (0.5197)
Oversize 1	mm (in.)	13.3 u6 - 13.3 M7 (0.5236)
Oversize 2	mm (in.)	13.4 u6 - 13.4 M7 (0.5275)

Total length	mm (in.)	43.5 (1.713)
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Valve guide inside diameter (installed)		
Standard size	mm (in.)	7.0 H7 (0.2756)
Oversize 1	mm (in.)	7.1 H7 (0.2795)
Oversize 2	mm (in.)	7.2 H7 (0.2835)

Installing temperature		
Cylinder head	°C (°F)	+ 50 (+ 120)
Valve guide	°C (°F)	- 150 (- 240)

Valve guide protrusion	mm (in.)	14.5 (0.571)
------------------------	----------	--------------

ENGINE M 20		B 20	B 25
11 – 34			
11 12 ... Valve Seat Inserts			
Valve seat insert dia. – bore dia. (distance "D")			
Intake			
Standard size	mm (in.)	42.15 g6 – 42.00 H7 (1.6594 – 1.6535)	43.15 g6 – 43.00 H7 (1.6968 – 1.6929)
Oversize 0.2 mm (0.0079")	mm (in.)	42.35 g6 – 42.20 H7 (1.6673 – 1.6614)	43.35 g6 – 43.20 H7 (1.7067 – 1.7008)
Oversize 0.4 mm (0.0157")	mm (in.)	42.55 g6 – 42.40 H7 (1.6752 – 1.6693)	43.55 g6 – 43.40 H7 (1.7146 – 1.7086)
Exhaust			
Standard size	mm (in.)	37.65 g6 – 37.50 H7 (1.4823 – 1.4764)	
Oversize 0.2 mm (0.0079")	mm (in.)	37.85 g6 – 37.70 H7 (1.4901 – 1.4842)	
Oversize 0.4 mm (0.0157")	mm (in.)	38.05 g6 – 37.90 H7 (1.4980 – 1.4921)	
Valve seat insert height – bore depth (distance "H")			
Standard size	mm (in.)	7.3 h11 (0.287) – 7.0 \pm $\frac{0.2}{0.1}$ (0.275 \pm $\frac{0.008}{0.004}$)	
Oversize 0.2 mm (0.008")	mm (in.)	7.5 h11 (0.295) – 7.2 \pm $\frac{0.2}{0.1}$ (0.283 \pm $\frac{0.008}{0.004}$)	
Oversize 0.4 mm (0.016")	mm (in.)	7.7 h11 (0.303) – 7.4 \pm $\frac{0.2}{0.1}$ (0.291 \pm $\frac{0.008}{0.004}$)	
Installing temperature			
Valve seat insert	°C (°F)	+ 50 (+ 120)	
Cylinder head	°C (°F)	– 150 (– 240)	

Valve seat inserts installed flush with cylinder head plane

ENGINE M 20

B 20

B 25

11 – 35

11.12 Valve Seats

Valve seat angle

°

45

Correction angles

°

15/75

Valve seat width
(distance "B")

Intake

mm (in.)

1.65 ± 0.35 (0.065 ± 0.014)

Exhaust

mm (in.)

1.65 ± 0.35 (0.065 ± 0.014)

Valve seat diameter
(distance "M")

Intake

mm (in.)

38.6 (1.520)

40.6 (1.598)

Exhaust

mm (in.)

32.6 (1.283)

34.6 (1.362)

ENGINE M 20			B20		B 25	
11 - 36						
11 21 ... Crankshaft and Bearings						
Double classification						
Ground sizes of main bearing journals						
Standard size	red	mm	60.00	- 0.010 + 0.000		
	blue	mm	60.00	- 0.009 + 0.009		
Undersize 1	red	mm	59.75	- 0.010 + 0.000		
	blue	mm	59.75	- 0.009 + 0.009		
Undersize 2	red	mm	59.50	- 0.010 + 0.000		
	blue	mm	59.50	- 0.009 + 0.009		
Radial crankshaft bearing play		mm	0.03 .. 0.07			

ENGINE M 20			B 20		B 25	
11 - 36a						
11 21 ... Crankshaft and Bearings						
Triple Classification						
Ground sizes of main bearing journals						
Standard size	yellow	mm	59.984 .. 59.995			
	green	mm	59.977 .. 59.983			
	white	mm	59.971 .. 59.976			
Undersize 1 (0.25 mm)	yellow	mm	59.734 .. 59.740			
	green	mm	59.727 .. 59.733			
	white	mm	59.721 .. 59.726			
Undersize 2 (0.050 mm)	yellow	mm	59.484 .. 59.490			
	green	mm	59.477 .. 59.483			
	white	mm	59.471 .. 59.476			
Radial crankshaft bearing play		mm	0.020 ... 0.046			

ENGINE M 20

B 20

B 25

11 37

11.21 . Crankshaft and Bearings

Ground sizes of crankshaft thrust bearing

Standard size	mm (in.)	25.0 ± 0.053 ± 0.020 (0.9842 ± 0.0021)
Oversize 1	mm (in.)	25.2 ± 0.053 ± 0.020 (0.9921 ± 0.0021)
Oversize 2	mm (in.)	25.4 ± 0.053 ± 0.020 (1.0000 ± 0.0021)

Axial crankshaft play

mm (in.) 0.08 to 0.163 (0.0031 to 0.0064)

ENGINE M 20	B 20	B 25
11 – 38		

11 21 — Crankshaft and Bearings

Ground sizes of conrod bearing journal		
Standard size	mm (in)	44.975 to 44.991 (1.7707 to 1.7713)
Undersize 1 0.25 mm (0.010")	mm (in)	44.725 to 44.741 (1.7608 to 1.7614)
Undersize 2 0.50 mm (0.020")	mm (in)	44.475 to 44.491 (1.7510 to 1.7516)
Radial conrod bearing play	mm (in)	0.020 to 0.055 (0.0008 to 0.0022)

ENGINE M 20

B 20

B 25

11 39

11 21 . Crankshaft and Bearings

Max. imbalance of crankshaft
(dynamic without flywheel)

gcm

25

Measuring planes

center of bearing journals 1 and 7

Take-up

rollers on main bearings 2 and 6

Balancing speed

rpm

400

Max. runout on center main
bearing journal (crankshaft
running on outer bearing
journals)

mm (in)

0.15 (0.006)

Crankshaft throw

mm (in)

 66 ± 0.1 (2.598 \pm 0.004) 75 ± 0.1 (2.953 \pm 0.004)Max. surface finish of bearing
journalsRt (μ)

1.5

ENGINE M 20	B 20		B 25	
11 - 40				

11 22 Flywheel				
Max. axial runout measured on outside diameter	mm (in.)	0.1 (0.004)		
Minimum flywheel thickness (distance "A")	mm (in.)	25.1 \pm 0.1 (0.988 \pm 0.004)		

11 23 Vibration Damper				
Max. radial runout	mm (in.)	0.2 (0.008)		
Max. axial runout	mm (in.)	0.3 (0.012)		
Diameter	mm (in.)	200 (7.874)	235 (9.252)	
Color		black	—	

ENGINE M 20

B 20

B 25

11 - 41

11 24 ... Connecting Rods and Bearings

Conrod bush - outside dia.	mm (in.)	24 060 to 24 100 (0 9472 to 0 9488)
Inside dia.	mm (in.)	22 ± 0.003 (0.8661 \pm 0.0003)
Max. deviation in parallel of conrod bores with bearing shells at distance of 150 mm (5.905")	mm (in.)	0.04 (0.0016)
Max. distortion to one side	°	0° 30'
Max. deviation in weight of connecting rods in one engine (without bearing shells)	g	± 4
Big end	g	± 2
Small end	g	± 2
Big conrod bore dia.		
Red	mm (in.)	48 000 to 48 008 (1 8898 to 1 8900)
Blue	mm (in.)	48 009 to 48 016 (1 8901 to 1 8904)

ENGINE M 20

B 20

B 25

11 - 42

11.25 Pistons

Pistons and pins are matched – only replace together in pairs.

Weight class (die stamped or engraved)

weight difference of individual pistons maximum 10 grams + or -

Identification on piston

piston diameter, arrow for direction of installation and compression ratio

Piston dia. (checkpoint "A")

Standard size

mm (in.)

79.98 (3.149)

83.98 (3.306)

Intermediate size

mm (in.)

80.06 (3.152)

84.06 (3.309)

Oversize 1

mm (in.)

80.23 (3.159)

84.23 (3.316)

Oversize 2

mm (in.)

80.48 (3.168)

84.48 (3.326)

Piston running clearance

mm (in.)

0.01 to 0.04 (0.0004 to 0.0016)

Max. total wear clearance between
pistons and cylinders
(used engine)

mm (in.)

0.15 (0.006)

0.12 (0.005)

ENGINE M 20

B 20

B 25

11 – 43

11 25 ... Piston Rings

Groove 1 (plain compression ring)

End clearance	mm (in)	0.2 ... 0.5 (0.008 ... 0.020)
---------------	----------	-------------------------------

Side clearance	mm (in)	0.04 ... 0.08 (0.0016 ... 0.0031)
----------------	----------	-----------------------------------

Groove 2 (tapered compression ring)

End clearance	mm (in)	0.2 ... 0.5 (0.008 ... 0.020)
---------------	----------	-------------------------------

Side clearance	mm (in)	0.03 ... 0.07 (0.0012 ... 0.0027)
----------------	----------	-----------------------------------

Groove 3 (bevelled oil scraper ring)

End clearance	mm (in)	0.2 ... 0.5 (0.008 ... 0.020)
---------------	----------	-------------------------------

Side clearance	mm (in)	0.02 ... 0.05 (0.0008 ... 0.0020)
----------------	----------	-----------------------------------

ENGINE M 20		B 20		B 25	
11 44					
11 31 Camshaft					
Drive		toothed belt			
Axial running clearance		mm (in)	max. 0.2 (0.008)		
11 33 _ Rocker Arms					
Radial play		mm (in)	0.016 to 0.052 (0.0006 to 0.0020)		

ENGINE M 20		B 20		B 25	
11 - 45					
11 34 Valves					
Clearance of intake and exhaust valves					
At max 35° C (95° F) coolant temperature	mm (in.)	0.25 (0.010)			
At operating temperature (thermostat activated)	mm (in.)	0.30 (0.012)			
Min. valve head edge thickness (machining limit distance "A")					
Intake	mm (in.)	1.3 (0.051)		—	
Exhaust	mm (in.)	2.0 (0.079)		—	
Head dia. (distance "T")					
Intake	mm (in.)	40 (1.575)		42 (1.653)	
Exhaust	mm (in.)	34 (1.338)		36 (1.417)	
Stem dia. (distance "S")					
Standard size	mm (in.)	7.0 (0.275)			
Oversize 1	mm (in.)	7.1 (0.279)			
Oversize 2	mm (in.)	7.2 (0.283)			
Max. wear clearance between valve stem and valve guide (tilt clearance "K")					
	mm (in.)	0.8 (0.031)			

ENGINE M 20	B 20		B 26	
11 - 46				

11 40 Oil Supply

Lubricating system	forced oil circulation with pressure control valve in filtered oil circuit		
Oil grade	see Service Information of Gr. 00		
Total oil volume	ltr. (US/Imp. pts.)	4.25 (9.0 / 7.5)	4.25 + 0.75 (9.0 + 1.6 / 7.5 + 1.3) in oil cooler (only to be filled after repairing)
Oil volume in oil filter	ltr. (US/Imp. pts.)	0.25 (0.53 / 0.44)	
Oil consumption in liters (US/Imp. pints) per 100 kilometers (60 miles) see page 00 - 3	max. 0.15 (0.32 / 0.26)		

11 41 Oil Pump

Design	gear type		
Oil pressure at idle speed	bar (psi)	0.6 to 2.0 (7 to 28)	
Oil pressure at top speed	bar (psi)	4.0 to 6.0 (57 to 85)	
Relaxed spring length	mm (in.)	44 (1.732)	

11 52 Fan Clutch

Design	speed controlled vaco fan clutch
--------	----------------------------------

9 blade fan

Control speed	(cold)	rpm	2300 to 2700
---------------	--------	-----	--------------

	(warm)	rpm	2000 to 2400
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8 blade fan

Control speed	(cold)	rpm	2900 to 3700
---------------	--------	-----	--------------

	(warm)	rpm	2600 to 3400
--	--------	-----	--------------

Axial play of rotor

mm (in.)	max. 0.4 (0.016)
----------	------------------

Radial play of rotor

mm (in.)	0.5 (0.020)
----------	-------------

ENGINE M 20

B 20

B 25

T1 – 48

11.52 . Fan Clutch

Design		temperature and speed controlled visco fan clutch
Switching-on temperature	°C (°F)	82 ± 4 (180 ± 7)
Switching-off temperature	°C (°F)	≈ 80 (140)
Fan dia. / no. of blades	mm (in.)	420 (16.535) / 9
Fan speed at 3500 rpm engine speed (clutch operated)	rpm	2400 ± 100
Axial play of rotor	mm (in.)	max. 0.4 (0.016)
Radial play of rotor	mm (in.)	0.5 (0.020)

11.53 Thermostat (Coolant)

Opening temperature (stamped in thermostat)	°C (°F)	approx. 80 (175)
--	---------	------------------

ENGINE M 21	D 24 W	D 24 WA	
11 – 50			

11 00 Engine in General

Bore	mm (in)	80 (3.150)	
Stroke	mm (in)	81 (3.189)	
Effective displacement	cc	2443	
Compression ratio		22 : 1	
Power (to DIN 70020) at engine speed	KW/rpm	63 / 4600	85 / 4800
Max. engine speed	rpm	5150 ± 100	5350 ± 100
Max. constant engine speed	rpm	4600	4800
Max. torque at engine speed	Nm(ft lbs)/rpm	152 (111) / 2500	220 (159) / 2400
Compression (approx. same value for all cylinders)	bar (psi)	> 20 (284)	

DETERMINING OIL CONSUMPTION

Oil consumption can be measured for the first time after the car has been driven approximately 7,500 km. Oil consumption will be stable only after this distance. Measuring oil consumption requires that the engine does not leak.

Precise consumption can be determined by weighing. Drain engine oil having operating temperature. Allow 5 minutes drip time. Weigh and pour in specified amount of new engine oil. Drive car 1,000 km. Drain engine oil at operating temperature and weigh. Allow 5 minutes drip time. Engine oil density at room temperature is approx. 0.9 km/cubic dm (dm³).

Max. permissible oil consumption when measured* by weighing, 0.07 ltr. / 100 km

Example:

Poured in oil	—	drained oil	=	consumed oil
4,500 g	—	3,600 g	=	900 g

900 ÷ density 0.9 = 1,000 cm³ = 1 liter per 1,000 kilometers

Possible Causes for Excessive Oil Consumption.

1. Running-in process not completed.
2. Seats for valve stems damaged.
3. Pistons seized.
4. Piston rings installed wrong, broken or worn.
5. Excessive running clearance between valve stem and valve guide.

* Refer to Group 11 of Operating Fluids.

ENGINE M 21

D 24 W

D 24 WA

11 – 51

11 11 _ Crankcase

Cylinder bore diameter

Standard size

mm (in.)

 80.00 ± 0.01 (3.1496 \pm 0.0004)

Intermediate size

mm (in.)

 80.08 ± 0.01 (3.1527 \pm 0.0004)

Oversize 1

mm (in.)

 80.25 ± 0.01 (3.1594 \pm 0.0004)

Surface finish (plateau honed)

Rz (μ)

6 to 10

Max. cyl. bore out-of-true

mm (in.)

0.014 (0.0005)

Max. cyl. bore conicity

mm (in.)

0.014 (0.0005)

ENGINE M 21

D 24 W

D 24 WA

11 – 52

11.12 Cylinder Head

Cylinder head height
(cylinder head may not be
reground)

mm (in.)

148 ± 0.1 (5.827 ± 0.004)

Max. distortion over entire length
of cylinder head

mm (in.)

0.05 (0.002)

11.12 - Valve Guide

Valve guide inside diameter
(installed)

Standard size

mm (in.)

7.0 H7 (0.275)

Oversize 1

mm (in.)

7.1 H7 (0.278)

Oversize 2

mm (in.)

7.2 H7 (0.283)

Valve guide protrusion

mm (in.)

13.5 (0.531)

ENGINE M 21

D 24 W

D 24 WA

11 - 53

11 12 . Valve Seat

Valve seat angle

°

45

Correction angle:

°

0/65

Valve seat width (distance "B")

Intake

mm (in.)

1.75 ± 0.25 (0.069 ± 0.010)

Exhaust

mm (in.)

2.75 ± 0.25 (0.108 ± 0.010)

Valve stem dia. (distance "M")

Intake

mm (in.)

33.6 (1.323)

Exhaust

mm (in.)

29.6 (1.165)

Valve retraction (distance "R")

Intake

mm (in.)

0.65 to 0.85 (0.025 to 0.033)

Exhaust

mm (in.)

0.85 to 1.05 (0.033 to 0.041)

11 12 . Burner

Burner retraction (distance "B")

mm (in.)

0.02 to 0.67 (0.0008 to 0.0027)

ENGINE M 21

D 24 W

D 24 WA

11 S4

11.21 . Crankshaft and Bearings

- Triple Classification -

Ground sizes of main bearing journals

Standard size

yellow

mm (in.)

59.984 to 59.990 (2.3615 to 2.3618)

green

mm (in.)

59.977 to 59.983 (2.3613 to 2.3615)

white

mm (in.)

59.971 to 59.976 (2.3610 to 2.3612)

Undersize 1

0.25 mm

(0.010")

yellow

mm (in.)

59.734 to 59.740 (2.3517 to 2.3520)

green

mm (in.)

59.727 to 59.733 (2.3514 to 2.3517)

white

mm (in.)

59.721 to 59.726 (2.3512 to 2.3514)

Undersize 2

0.50 mm

(0.020")

yellow

mm (in.)

59.484 to 59.490 (2.3418 to 2.3421)

green

mm (in.)

59.477 to 59.483 (2.3416 to 2.3418)

white

mm (in.)

59.471 to 59.476 (2.3414 to 2.3416)

Radial crankshaft bearing play

mm (in.)

0.020 to 0.046 (0.0008 to 0.0018)

11 21 Crankshaft and Bearings

Ground sizes of crankshaft thrust bearing		
Standard size	mm (in.)	25.0 ± 0.053 (0.9842 \pm 0.0021)
Oversize 1	mm (in.)	25.2 ± 0.053 (0.9921 \pm 0.0021)
Oversize 2	mm (in.)	25.4 ± 0.053 (1.0000 \pm 0.0021)
Axial crankshaft play	mm (in.)	0.08 to 0.163 (0.0031 to 0.0064)

— Double Classification —

Ground sizes of conrod bearing journals:		
Standard size	mm (in.)	44.875 to 44.991 (1.7707 to 1.7713)
Undersize 1	mm (in.)	44.725 to 44.741 (1.7608 to 1.7614)
Undersize 2	mm (in.)	44.475 to 44.491 (1.7519 to 1.7516)
Radial conrod bearing play	mm (in.)	0.020 to 0.055 (0.0008 to 0.0022)

ENGINE M 21

D 24 W

D 24 WA

11 -- 86

11 21 ... Crankshaft and Bearings

Max. imbalance of crankshaft
(dynamic without flywheel)

gcm

50

Measuring planes

center of bearing journals 1 and 7

Take-up

with rollers on main bearings 2 and 6

Balancing speed

rpm

400

Max. runout on center main
bearing journal (crankshaft
running on outer bearing journals) mm (in)

0.15 (0.006)

Crankshaft throw

mm (in)

81 ± 0.1 (3.189 ± 0.004)

Max. surface finish of bearing
journals

Rz (µ)

1.5 (micro carrying share in 1 mm (0.039")) cutting depth tp₁ = 70 %)

ENGINE M 21

11 – 57

D 24 W

D 24 WA

11 22 Flywheel

Max. axial runout measured
on outside diameter

mm (in.)

0.1 (0.004)

Min. flywheel thickness
(distance "A")

mm (in.)

32.1 ± 0.1 (1.264 ± 0.004)

11 23 Vibration Damper

Max. radial runout

mm (in.)

0.2 (0.008)

Max. axial runout

mm (in.)

0.3 (0.012)

Diameter

mm (in.)

235 (9.252)

Color

gray

ENGINE M 21

D 24 W

D 24 WA

11 58

11 24 Connecting Rods and Bearings

Control bush — outside dia	mm (in.)	28.080 to 28.100 (1.1047 to 1.1063)
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inside dia	mm (in.)	26 ± 0.003 (1.0236 ± 0.0001)
------------	----------	---------------------------------------

Max. deviation in parallel of control bores with bearing shells at distance of 150 mm (5.905")	mm (in.)	0.04 (0.0016)
--	----------	---------------

Max. displacement to one side	°	$0^{\circ} 30'$
-------------------------------	---	-----------------

Max. deviation in weight of connecting rods in one engine (without bearing shells)	g	± 4
--	---	---------

Big end	g	± 2
---------	---	---------

Small end	g	± 2
-----------	---	---------

— Double Classification —

Big control end diameter Rod	mm (in.)	48.000 to 48.008 (1.8898 to 1.8900)
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Blue	mm (in.)	48.009 to 48.016 (1.8901 to 1.8904)
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ENGINE M 21 11 59	D 24 W	D 24 WA	
11 25 ... Pistons	Pistons and pins are matched — only replace together in pairs		
Weight class (die-stamped or engraved)	+ or — (max. weight difference of all pistons 10 grams)		
Identification on piston	piston die , arrow for installed direction, compression ratio		
Piston dia. (checkpoint "A") Standard size mm (in.)	<div> <div>Alcan 79.965 (3.1482)</div> <div>KS 79.950 (3.1476)</div> <div>König/Mahle 79.965 (3.1482)</div> </div> <div>König/Mahle 79.945 (3.1474)</div>		
Intermediate size mm (in.)	<div> <div>Alcan 80.045 (3.1514)</div> <div>KS 80.030 (3.1508)</div> <div>König/Mahle 80.045 (3.1514)</div> </div> <div>König/Mahle 80.025 (3.1500)</div>		
Oversize 1 mm (in.)	<div> <div>Alcan 80.215 (3.1581)</div> <div>KS 80.200 (3.1575)</div> <div>König/Mahle 80.215 (3.1581)</div> </div> <div>König/Mahle 80.195 (3.1573)</div>		
Piston running clearance mm (in.)	<div> <div>Alcan 0.026 to 0.054 (0.0010 to 0.0021)</div> <div>KS 0.034 to 0.076 (0.0013 to 0.0030)</div> <div>König/Mahle 0.026 to 0.054 (0.0010 to 0.0021)</div> </div> <div>König/Mahle 0.046 to 0.074 (0.0018 to 0.0029)</div>		
Max. total wear clearance between pistons and cylinders (used engine) mm (in.)	<div>0.15 (0.006)</div>		

ENGINE M 21

11 60

D 24 W

D 24 WA

11 25 . Piston Rings

Groove 1 (keystone ring)		
End clearance	mm (in.)	0.2 to 0.4 (0.008 to 0.016)
Side clearance	mm (in.)	0.06 to 0.14 (0.0024 to 0.0055)
Groove 2 (taper face ring)		
End clearance	mm (in.)	0.2 to 0.4 (0.008 to 0.016)
Side clearance	mm (in.)	0.05 to 0.08 (0.0020 to 0.0031)
Groove 3 (oil scraper ring with spring)		
End clearance	mm (in.)	0.25 to 0.50 (0.010 to 0.020)
Side clearance	mm (in.)	0.03 to 0.06 (0.0012 to 0.0024)

ENGINE M 21

D 24 W

D 24 WA

11 – 61

11.31 Camshaft

Drive		toothed belt	
Axial running clearance		mm (in.)	
		0,15 to 0,33 (0.006 to 0.013)	
Cam distance "N"			
Intake cams	mm (in.)	34,237 (1.3479)	34,023 (1.3395)
Exhaust cams	mm (in.)	34,241 (1.3481)	34,241 (1.3481)
Max. wear on used cam peaks	mm (in.)	0,1 (0.004)	



ENGINE M 21

D 24 W

D 24 WA

11 — 62

11 24 . . Valves

Intake and exhaust valve clearance "V"

At max. 35° C (95° F) coolant
temperature

mm (in.)

0.30 (0.012)

At operating temperature
(thermostat activated)

mm (in.)

0.35 (0.014)

Valve head dia. (distance "T")

Intake

mm (in.)

35 (1.378)

Exhaust

mm (in.)

31 (1.220)

Valve retraction (distance "R")

Intake

mm (in.)

0.85 to 0.85 (0.035 to 0.033)

Exhaust

mm (in.)

0.85 to 1.05 (0.033 to 0.041)

Stem dia. (distance "S")

Standard size

mm (in.)

7.0 (0.276)

Oversize 1

mm (in.)

7.1 (0.279)

Oversize 2

mm (in.)

7.2 (0.283)

Max. wear play between valve
stem and valve guide

(tilt clearance "K")

mm (in.)

0.8 (0.031)

ENGINE M 21

11 - 63

D 24 W

D 24 WA

11 40 .. Oil Supply**Lubricating system**

forced oil circulation with pressure control valve in filtered oil circuit

Oil grade

see Service Information of Gr. 00

Total oil volume

ltr. (US/Imp pts.)

5.25 (11.1/9.2)

5.75 (12.1/10.1)

ltr. (US/Imp pts.)

6.50 (13.7/11.4) with oil cooler
(only filled after repairing)**Oil volume in oil filter**

ltr. (US/Imp pts.)

1.25 (2.6 / 2.2)

**Oil consumption in liters (US/Imp. pints)
per 100 kilometers (60 miles)**

see page 00 - 3

max. 0.15 (0.32 / 0.26)

ENGINE M 21

11 – 64

D 24 W

D 24 WA

11.41 . . Oil Pump

Design

gear-type

Oil pressure at idle speed

bar (psi)

0.5 to 2.0 (7 to 28)

Oil pressure at top speed

bar (psi)

4.0 to 6.0 (57 to 85)

Reflexed spring length

mm (in.)

71.6 (2.819)

ENGINE M 21

D 24 W

D 24 WA

11 - 65

11 S1 . Water Pump

Clearance between cover in
body and impeller

mm (in.)

0.4 to 0.8 (0.016 to 0.031)

Upper edge of flange to
end of shaft

mm (in.)

11.2 ± 0.1 (0.441 ± 0.004)

ENGINE M 21

11 66

D 24 W

D 24 WA

11.52 Fan Clutch

Design	temperature and speed controlled viscous fan clutch	
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Switching-on temperature	°C (°F)	92 ± 4 (198 ± 7)	82 ± 4 (180 ± 7)
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Switching-off temperature	°C (°F)	≥ 60 (140)	
---------------------------	---------	------------	--

Fan dia. / no. of blades	mm (in.)	420 (16.535) / 9	
--------------------------	----------	------------------	--

Fan speed at engine speed of 3500 rpm (clutch activated)	rpm	2400 ± 100	
--	-----	------------	--

Max. axial play of rotor	mm (in.)	0.4 (0.016)	
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Radial play of rotor	mm (in.)	0.5 (0.020)	
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ENGINE M 21		D 24 W	D 24 WA	
11 – 67				
11 53 ... Thermostat (Coolant)				
Opening temperature (stamped in thermostat)	°C (°F)	approx. 80 (175)		
11 61 ... Charging Pressure Blowoff Valve				
Opening pressure	bar (psi)		1.0 ± 0.1 (14 ± 1.4)	
11 65 ... Turbocharger				
Charging pressure (in load range above 2500 rpm)	bar (psi)		0.76 to 0.90 (11 to 13)	
Maximum bearing play				
Axial	mm (in.)		0.15 (0.006)	
Radial	mm (in.)		0.80 (0.031)	
11 66 ... Vacuum Pump				
Minimum vacuum	mbar	530		

11 - 400 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 00 Engine - General

In-line engine

Cylinders

4

4

4

4

Bore

mm

84

84

84

84

Stroke

mm

72

81

72

81

Effective displacement

cm³

1596

1796

1596

1796

Compression ratio

:1

9.0

8.8

9.7

9.7

Net output (DIN 70 020)

KW

75/5500 *

85/5500 *

at

rpm

73/5500 **

83/5500 **

75/5500

65/5500

Max. engine speed

rpm

6200

6200

6200

6200

Max. continuous engine speed

rpm

6000

6000

6000

6000

Max. torque

Nm

143/4250 *

165/4250 *

at

rpm

141/4250 **

162/4250 **

158/3900

168/3900

Compression (roughly equal readings for all cylinders)

bar

min. 10 - 11

min. 10 - 11

min. 10 - 11

min. 10 - 11

* without catalytic converter

** with catalytic converter

11 - 401 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 11 Engine block

Bore dia. mm 84.00 ± 0.014

Bore intermediate size mm 84.050 ± 0.014

1st overbore mm 84.250 ± 0.014

2nd overbore mm 84.500 ± 0.014

Maximum cyl.-bore ovality mm 0.01

Maximum cyl.-bore taper mm 0.01

11 - 402 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 12 Cylinder head with cover

Cylinder head height - factory

141.0

141.0

Planing limit* mm

140.95

140.95

Valve guides not available as replacement parts

Valve guide internal diameters
(installed)

Factory mm

7.0 H7

7.0 H7

Stage 1 mm

7.1 H7

7.1 H7

Stage 2 mm

7.2 H7

7.2 H7

Deflection angle*, max. mm
(between valve and guide)

0.5

0.5

* See Repair Manual

11 - 403 Engine		M40 B16	M40 B18	M43 B16	M43 B18
11 12	Cylinder head and cover				
Valve seat angle	°	45°			
Correction angle	Outside °	15°			
	Inside °	60°			
Valve seat width (Dimension "B")					
Intake	mm	1.65 ± 0.25			
Exhaust	mm	3.0 ± 0.25			
Valve seat diameter					
Intake	Outside diameter mm	dia. 41.4			
Exhaust	Outside diameter mm	dia. 35.6			

11 - 404 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 21 Crankshaft and bearings

Main bearing journal undersizes

Factory	yellow mm	59.984 .. 59.990
	green mm	59.977 .. 59.983
	white mm	59.971 .. 59.976

1st undersize (U 0.25)	yellow mm	59.734 .. 59.740
	green mm	59.727 .. 59.733
	white mm	59.721 .. 59.726

2nd undersize (U 0.50)	yellow mm	59.484 .. 59.490
	green mm	59.477 .. 59.483
	white mm	59.471 .. 59.476

Crankshaft bearing radial

clearance	mm	0.020 .. 0.046
-----------	----	----------------

11 - 405 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11.21 Crankshaft and main bearings

Crankshaft main bearing oversizes

Factory	mm	25.0 F8
---------	----	---------

1st oversize	mm	25.2 F8
--------------	----	---------

2nd oversize	mm	25.4 F8
--------------	----	---------

Crankshaft end float	mm	0.088 . 0.163
----------------------	----	---------------

Conrod journal underizes

Factory	mm	44.975 +0.018
---------	----	---------------

1st undersize	mm	44.725 +0.018
---------------	----	---------------

2nd undersize	mm	44.475 +0.018
---------------	----	---------------

Connecting rod bearing radial clearance	mm	0.010 . 0.052
---	----	---------------

Max. allowed runout at center main journal as measured at main bearings 1 & 5	mm	0.15
---	----	------

11 - 406 Engine	M40 B16	M40 B18	M43 B16	M43 B18
11.22 Flywheel Max. axial runout as measured at periphery mm			0.1	

11 - 407 Engine		M40 B16	M40 B18	M43 B16	M43 B18
11 23	Harmonic balancer				
Maximum radial runout	mm	0.40			
Maximum end float	mm	0.60			

11 - 408 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 24 Connecting rods and bearings

Big-end diameter, large mm 48.000 ± 0.016

Wristpin bushing

Outside diameter mm 24.000 ± 0.004

Inside diameter mm 22.005 ± 0.007

Parallel deviation of connecting
rod bores at 150 mm distance,
with inserts max. mm

0.04

Max. twist to one side max. °

0.5

Allowed weight difference
between connecting rods
(without inserts) g

± 4

Big end g

± 2

Wristpin end g

± 2

11 - 409 Engine

M40 B16

M40 B18

M40 B16

M43 B18

11.25 Pistons with rings and wristpins

Pistons and wristpins are matched
- always replace in sets

Piston diameter

Factory - Stage 0

mm

83.985

Stage 00

mm

84.065

1st oversize +0.25

mm

84.305

2nd oversize +0.50

mm

84.485

Piston installation clearance

mm

0.01 ... 0.04

Max. allowed wear between piston
and cylinder wall
(used engine)

mm

0.15

11 - 410 Engine

		M40 B16	M40 B18	M43 B16	M43 B18
11.25	Pistons with rings and wristpins				
1st groove (top compression ring)					
End gap	mm	0.2 ... 1.0 *	0.2 ... 1.0 *	0.2 ... 1.0 *	0.2 ... 1.0 *
Groove clearance	mm	0.02 ... 0.20 *	0.02 ... 0.20 *	0.02 ... 0.20 *	0.02 ... 0.20 *
2nd groove (taper-face ring)					
End gap	mm	0.2 ... 1.0 *	0.2 ... 1.0 *	0.2 ... 1.0 *	0.2 ... 1.0 *
Groove clearance	mm	0.020 ... 0.1 *	0.020 ... 0.1 *	0.020 ... 0.1 *	0.020 ... 0.1 *
3rd groove (oil-scraping ring with spring)					
End gap	mm	0.2 ... 1.0 *	-	-	-
Groove clearance	mm	0.020 ... 0.1 *	-	-	-
3rd groove (3-piece steel band ring)					
End gap	mm	-	0.4 ... 1.4	0.4 ... 1.4	0.4 ... 1.4
Groove clearance	mm	-	not measured	not measured	not measured
* Wear limit					

11 - 411 Engine

M40 B16

M40 B18

M40 B18

M40 B18

11 31 Camshaft

Pilot bearing (camshaft)

Width mm

23 H9

Pilot bearing (cylinder head)

Width mm

23 d8

Runout

Radial mm

0.020 - 0.061

End float mm

0.065 - 0.150

11 - 412 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 34 Valves and springs

Head diameter

Intake	mm	42
--------	----	----

Exhaust	mm	36
---------	----	----

Stem diameter

Intake	mm	6.975 -0.011
--------	----	--------------

Exhaust	mm	6.95 -0.011
---------	----	-------------

Repair valves
In addition to the standard valves,
the following oversizes are also
available

Stem diameter

Intake	1st oversize mm	7.1 -0.011 - 0.016
--------	-----------------	--------------------

	2nd oversize mm	7.2 -0.011 - 0.016
--	-----------------	--------------------

Stem diameter

Exhaust	1st oversize mm	7.1 -0.016 - 0.021
---------	-----------------	--------------------

	2nd oversize mm	7.2 -0.016 - 0.021
--	-----------------	--------------------

11 - 413 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11-40 Lubrication system

Oil specification *

Engine oil consumption *

Oil capacity

with filter change

ltr.

4,0

Without filter change

ltr.

3,75

* See Specifications for Fuels, Fluids
and Lubricants

11 - 414 Engine

M40 B16

M40 B18

M43 B16

M43 B18

11 41 Oil pump with filter screen and drive

Oil pressure, at idle min. bar

0.5

Bypass opening pressure bar

4.3 ± 0.2

11 - 415 Engine		M40 B16	M40 B18	M43 B16	M43 B18
11 52	Fan				
Fan clutch					
Lockup temperature	°C	92 +4			
Release temperature	°C	80			
TIR play of bearing (156 mm diameter)	mm	± 0.65			

11 - 416 Engine

M40 B16

M40 B19

M43 B16

M43 B19

11 53 Thermostat and connections

Starts to open at
(stamped on housing) °C

88

92

11 00 ... Engine In General

Design		In-line, 4 cylinders
Bore	mm (in.)	84 (3.307)
Stroke	mm (in.)	81 (3.189)
Effective displacement	cm ³ (in. ³)	1796 (109.5)
Compression ratio		10.0 : 1
Power output (to DIN 70 020)	KW	100
at engine speed	rpm	6000
Max. engine speed	rpm	6500
Max. torque	Nm (ft. lbs.)	172 (124)
at engine speed	rpm	4500
Compression pressure (approx. same value for all cylinders)	bar (psi)	at least 10 to 11 (142 to 156)

11 00 ... Engine Oil Consumption

DETERMINING OIL CONSUMPTION

Oil consumption can be measured for the first time after the car has been driven approximately 7,500 km. Oil consumption will be stable only after this distance. Measuring oil consumption requires that the engine does not leak.

Precise consumption can be determined by weighing. Drain engine oil having operating temperature. Allow 5 minutes drip time. Weigh and pour in specified amount of new engine oil. Drive car 1,000 km. Drain engine oil at operating temperature and weigh. Allow 5 minutes drip time. Engine oil density at room temperature is approx. 0.9 km³/cubic dm (dm³).

Max. permissible oil consumption when measured* by weighing: 0.07 lit. / 100 km.

Example:

Poured in oil	—	drained oil	=	consumed oil.
4,500 g	—	3,600 g	=	900 g

$900 : \text{density } 0.9 = 1,000 \text{ cm}^3 = 1 \text{ liter per } 1,000 \text{ kilometers}$

Possible Causes for Excessive Oil Consumption*

1. Running-in process not completed.
2. Seats for valve stems damaged.
3. Pistons seized.
4. Piston rings installed wrong, broken or worn.
5. Excessive running clearance between valve stem and valve guide.

* Refer to Group 11 of Operating Fluids

11 11 ... Crankcase

Cylinders		
Bore dia.	mm (in.)	84.000 \pm 0.014 (3.3071 \pm 0.0005)
Intermediate size	mm (in.)	84.080 \pm 0.014 (3.3103 \pm 0.0005)
1st oversize	mm (in.)	84.260 \pm 0.014 (3.3170 \pm 0.0005)
2nd oversize	mm (in.)	84.500 \pm 0.014 (3.3268 \pm 0.0005)
Surface finish	Ra (μ)	3 ... 4
Max. cyl. bore out-of-true	mm (in.)	0.01 (0.0004)
Max. cyl. bore conicity	mm (in.)	0.01 (0.0004)

11 12 ... Cylinder Head

Cylinder head height Standard size	mm	140.0
Machined limit *	mm	139.55
Valve guides	valve guides are not available as replacement parts	
Valve guide inside dia. (Installed) Standard size	mm	7.0 H7
Oversize 1	mm	7.1 H7
Oversize 2	mm	7.2 H7
Max. tilt clearance "K" (wear between valve and valve guide)	mm	0.5

11.12 ... Valve Seat Inserts

Valve seat insert dia. / bore dia.
(distance D)

Intake

Standard size	mm (in.)	34.1 k8 / 34.0 H7 (1.3426 - 1.3386)
Oversize 0.2 mm (0.008")	mm (in.)	34.3 k8 / 34.2 H7 (1.3504 / 1.3465)
Oversize 0.4 mm (0.016")	mm (in.)	34.5 k8 / 34.4 H7 (1.3583 - 1.3544)

Exhaust

Standard size	mm (in.)	31.6 k8 / 31.5 H7 (1.2441 - 1.2402)
Oversize 0.2 mm (0.008")	mm (in.)	31.8 k8 / 31.7 H7 (1.2520 - 1.2481)
Oversize 0.4 mm (0.016")	mm (in.)	32.0 k8 / 31.9 H7 (1.2599 - 1.2559)

Valve seat insert height

Intake

Standard size	mm (in.)	7.3 ^{+0.1} _{-0.04} (0.287 ^{+0.004} _{-0.001})
Oversize 0.2 mm (0.008")	mm (in.)	7.5 ^{+0.1} _{-0.04} (0.295 ^{+0.004} _{-0.001})
Oversize 0.4 mm (0.016")	mm (in.)	7.7 ^{+0.1} _{-0.04} (0.303 ^{+0.004} _{-0.001})

Exhaust

Standard size	mm (in.)	7.3 ^{+0.1} _{-0.04} (0.287 ^{+0.004} _{-0.001})
Oversize 0.2 mm (0.008")	mm (in.)	7.5 ^{+0.1} _{-0.04} (0.295 ^{+0.004} _{-0.001})
Oversize 0.4 mm (0.016")	mm (in.)	7.7 ^{+0.1} _{-0.04} (0.303 ^{+0.004} _{-0.001})

Installing temperature

Valve seat insert	°C (°F)	+ 150 (+ 300)
-------------------	---------	---------------

Cylinder head	°C (°F)	+ 20 (+ 68)
---------------	---------	-------------

ENGINE M 42		M 42 B 10
11 - 455		
11 12 ... Valve Seats		
Valve seat angle	degr.	45°
Correction angles	degr.	15°
	degr.	60°
Valve seat width (dimension "B")		
Intake	mm	1.65 ± 0.25
Exhaust	mm	1.65 ± 0.25
Valve seat outside diameter		
Intake	mm	32.4
Exhaust	mm	30.1

11.31 ... Crankshaft and Bearings

Ground sizes of main bearing journal					
Standard size	yellow	mm (in.)	59.954 ... 59.990	(2.3616	2.3618)
	green	mm (in.)	59.977 ... 59.983	(2.3613	2.3615)
	white	mm (in.)	59.971 ... 59.976	(2.3611	2.3613)
Undersize 1 0.25 mm (0.0098")	yellow	mm (in.)	59.734 ... 59.740	(2.3517	2.3520)
	green	mm (in.)	59.727 ... 59.733	(2.3515	2.3517)
	white	mm (in.)	59.721 ... 59.726	(2.3512	2.3514)
Undersize 2 0.50 mm (0.0232")	yellow	mm (in.)	59.484 ... 59.490	(2.3418	2.3421)
	green	mm (in.)	59.477 ... 59.483	(2.3416	2.3418)
	white	mm (in.)	59.471 ... 59.476	(2.3414	2.3416)
Radial crankshaft bearing play			0.020 ... 0.058	(0.0008 ... 0.0023)	

11 21 . Crankshaft and bearings

Ground sizes of crankshaft thrust bearing

Standard size	mm (in.)	$25.0^{+0.053}_{+0.020}$	$(0.9843^{+0.0021}_{+0.0008})$
---------------	----------	--------------------------	--------------------------------

Oversize 1	mm (in.)	$25.2^{+0.053}_{+0.020}$	$(0.9881^{+0.0021}_{+0.0008})$
------------	----------	--------------------------	--------------------------------

Oversize 2	mm (in.)	$25.4^{+0.053}_{+0.020}$	$(1.0000^{+0.0021}_{+0.0008})$
------------	----------	--------------------------	--------------------------------

Axial crankshaft play	mm (in.)	0.08 0.143 (0.0031 0.0056)
-----------------------	----------	----------------------------------

11 21 ... Crankshaft and Bearings

Ground sizes of crank bearing journal

Standard size

mm (in.)

$$45.00 \begin{matrix} + 0.009 \\ + 0.025 \end{matrix} (1.7717 \begin{matrix} + 0.0004 \\ + 0.0010 \end{matrix})$$

Undersize 1

mm (in.)

$$44.75 \begin{matrix} + 0.009 \\ + 0.025 \end{matrix} (1.7618 \begin{matrix} + 0.0004 \\ + 0.0010 \end{matrix})$$

Undersize 2

mm (in.)

$$44.50 \begin{matrix} + 0.009 \\ + 0.025 \end{matrix} (1.7520 \begin{matrix} + 0.0004 \\ + 0.0010 \end{matrix})$$

Radial crank bearing play

mm (in.)

$$0.020 \dots 0.053 (0.0008 \dots 0.0022)$$

11 21 . Crankshaft and Bearings

Max. crankshaft imbalance (dyn. without flywheel)	gcm	25
Measuring planes:		middle of main bearing
Take-up		with rollers on main bearings 1 and 5
Balancing speed	rpm	400
Max. runout on middle main bearing journal (crankshaft running on outer bearing journals)	mm (in.)	0.15 (0.006)
Crankshaft throw	mm (in.)	61.0 ± 0.1 (2.399 ± 0.004)
Max. surface finish of bearing journals	RA (μ)	1.5

11.22 ... Flywheel

Max. runout measured on
outside diameter

mm (in.)

0.1 (0.004)

Min. thickness of flywheel
(distance "A")

mm (in.)

max. 23.2 mm (0.913") between friction surface and bolted surface of clutch housing
(+ shell flywheel)

ENGINE M 42

M 42 B 18

11 - 461

11 24 ... Connecting Rods and Bearings

Big conrod end bore dia.

Red

mm

48.008 ... 48.008

Blue

mm

48.009 .. 48.016

Conrod bush

Outside dia.

mm

24.060 .. 24.100

Inside dia.

mm

$$22 \begin{matrix} + 0.010 \\ - 0.003 \end{matrix}$$

Max. deviation in parallel of con-
rod bores with bearing shells at
distance of 145 mm

mm

0.04

Max. displacement to one side

0° - 30°

Max. deviation in weight of con-
necting rods in one engine
(without bearing shells)

g

± 4

Big end

g

± 2

Small end

g

± 2

11 25 , Pistons		Pistons and pins are matched - always only replace together.
Weight class (die-stamped or engraved)		max. difference in weight among pistons 10 g + or -
Identification on piston		
Engine type / displacement		1.8 / 10
Compression ratio		
Piston dia. (checkpoint "A")		
Standard size	mm (in.)	83.98 (3.3063)
Intermediate size	mm (in.)	84.06 (3.3094)
Over size 1	mm (in.)	84.23 (3.3161)
Over size 2	mm (in.)	84.48 (3.3259)
Piston running clearance	mm (in.)	0.01 - 0.04 (0.0004 - 0.0016)
Max. total wear clearance between piston and cylinder (used engine)	mm (in.)	0.15 (0.0059)

11 25 ... Piston Rings

Groove 1
(plain compression ring)

End clearance	mm (in.)	0.2 ... 0.4 (0.008 ... 0.016)
---------------	----------	-------------------------------

Side clearance	mm (in.)	0.02 ... 0.052 (0.0008 ... 0.0020)
----------------	----------	------------------------------------

Groove 2
(taper face ring)

End clearance	mm (in.)	0.2 ... 0.4 (0.008 ... 0.016)
---------------	----------	-------------------------------

Side clearance	mm (in.)	0.020 ... 0.052 (0.0008 ... 0.0020)
----------------	----------	-------------------------------------

Groove 3
(oil scraper ring with hose-lined spring)

End clearance	mm (in.)	0.2 ... 0.45 (0.008 ... 0.018)
---------------	----------	--------------------------------

Side clearance	mm (in.)	0.020 ... 0.055 (0.0008 ... 0.0022)
----------------	----------	-------------------------------------

11.31 Camshaft

Axial play	mm (in.)	0.15 ... 0.33 (0.006 ... 0.013)
Radial play	mm (in.)	0.026 ... 0.054 (0.0008 ... 0.0021)
Cam height	mm (in.)	47.7 ± 0.06 (1.8779 ± 0.0024)

11.34 ... Valves

Valve head diameter

Intake

mm

33.0

Exhaust

mm

30.5

Valve stem diameter

Intake

mm

6.975 / 6.975 ** - 0.015

Exhaust

mm

6.960 * / 6.960 ** - 0.015

Following valve versions are available for repairs in addition to the standard valves

Valve stem diameter

Intake

mm

7.075 / 6.075 ** - 0.015

Exhaust

mm

7.060 * / 6.060 ** - 0.015

Head oversize

mm

0.2

Identification on stem

R1

Valve stem diameter

Intake

mm

7.175 / 6.175 ** - 0.015

Exhaust

mm

7.160 * / 6.160 ** - 0.015

Head oversize

mm

0.4

Identification on stem

R2

* Exhaust valves are sodium filled.

Refer to information in Construction Group Repair Manual and Service Information Bulletins.

** Since 8.82

Engine M 42

M 42 B 18

11 - 466

11 40 - Oil Supply

Lubricating system

forced oil circulation with pressure control valve in unfiltered oil circuit

Oil grade

see Service Information Group 00

Oil change volume
with oil filter

ltr. (US/imp. pts.)

4.65 (10.25/8.54)

without oil filter

ltr. (US/imp. pts.)

4.39 (9.29/7.73)

11 41 ... Oil Pump

Oil pump design

internal gear-type pump

Oil pressure
at idle speed

bar (psi)

1.3 ... 2.0 (18 ... 28)

at maximum speed

bar (psi)

4.0 ... 4.3 (57 ... 61)

Radial play of outer rotor
pump body

mm (in.)

0.120 ... 0.195 (0.0047 ... 0.0077)

Axial play
inner rotor

mm (in.)

0.02 ... 0.065 (0.0008 ... 0.0026)

Outer rotor

mm (in.)

0.04 ... 0.09 (0.0016 ... 0.0035)

Length of relaxed spring

mm (in.)

84.1 (3.311)

11 42 ... Oil Filter

Full flow oil filter

bypass opening pressure

bar (psi)

2.5 ... 3.5 (36 ... 51)

Engine M 42

M 42 B 18

11 - 468

11 53 . . . Thermostat (Coolant)

Opening temperature
(stamped in thermostat)

°C (°F)

88 (190)

ENGINE		S 14	M 80/3
11 - 800		a) M 3 b) 330ls a*) M 3 / II 2	M 638 CSI
11 00 ... Engine in General			
- European Version -			
Bore	mm	93.4	93.4
Stroke	mm	a) 84.0 b) 72.6	84.0
Effective displacement	cm ³	a) 2302 b) 1990	2453
Compression ratio		a) 10.5 : 1 b) 10.8 : 1 a*) 11.0 : 1	10.5 : 1
Power (to DIN 70020) / at engine speed	KW / rpm	a) 147/6900 b) 141/6800 a*) 162/6750	210/6500
Governed shut-off speed	rpm	7240 ± 60	6900
Max. constant speed	rpm	6900	6500
Max. torque / at engine speed	Nm / rpm	a) 245/4750 b) 216/4600	340/4500
Compression (approx. same value for all cylinders)	bar	at least 10 - 11	at least 10 - 11

ENGINE		S 14	S 30 B 35	S 30 B 36
11 - 300a		M 3	M 5/E 20; M 635 CSI	M 5/E 34
11 00 - Engine in General - Catalytic Converter Version-				
Bore	mm (in.)	93.4 (3.677)		
Stroke	mm (in.)	84 (3.307)	84 (3.307)	86 (3.386)
Effective displacement	cc	2302	3453	3535
Compression ratio		10.5 : 1	9.8 : 1	10.0 : 1
Power (to DIN 70 020)	KW	143	191	232
at engine speed	rpm	6750	6500	6900
Top engine speed	rpm	7250	6900	7200
Max. constant engine speed	rpm	6900	6500	6800
Max. engine torque	Nm (ft. lbs.)	230 (166)	330 (239)	360 (260)
at engine speed	rpm	4750	4500	4750
Compression pressure (approx. same value for all cylinders)	bar (psi)	at least 10 to 11 (142 to 156)		

ENGINE

11 - 900 b

S 14

M 88-3

S 38

11 09 - Engine Oil Consumption**DETERMINING OIL CONSUMPTION**

Oil consumption can be measured for the first time after the car has been driven approximately 7,500 km (4,500 miles). Oil consumption will be stable only after this distance. Measuring oil consumption requires that the engine does not leak.

Permissible oil consumption could be up to 0.15 liter/100 kilometers.

Precise consumption can be determined by weighing. Drain engine oil having operating temperature. Allow 5 minutes drip time. Weigh and pour in specified amount of new engine oil. Drive car 1,000 km (600 miles). Drain engine oil at operating temperature and weigh. Allow 5 minutes drip time. Engine oil density at room temperature is approx. 0.9 gm-cubic cm.

Example: poured in oil - drained oil = consumed oil.

$$4,500 \text{ g} - 3,600 \text{ g} = 900 \text{ g}$$

900 : density 0.9 = 1,000 cu. cm = 1 liter per 1,000 kilometers (600 miles).

Possible Causes for Excessive Oil Consumption.

1. Running-in process not completed.
2. Seals for valve stems damaged.
3. Pistons seized.
4. Piston rings installed wrong, broken or worn.
5. Excessive running clearance between valve stem and valve guide.

ENGINE	S 14	M 88 - 3	S 38
11 – 801			

11 11 ... Crankcase			
Cylinder bore diameter			
Standard size	mm (in.)	93.40 \pm 0.01 (3.6771 \pm 0.0004)	
Intermediate size	mm (in.)	93.45 \pm 0.01 (3.6791 \pm 0.0004)	
Over size 1	mm (in.)	93.60 \pm 0.01 (3.6850 \pm 0.0004)	
Over size 2	mm (in.)	93.80 \pm 0.01 (3.6929 \pm 0.0004)	
Surface finish	Ra (µ)	0.2 to 0.4	
Max. cyl. bore concentricity	mm (in.)	± 0.005 (0.0002)	
Max. cyl. bore conicity	mm (in.)	0.01 (0.0004)	

ENGINE		S 14	M 88/3	S 38 B 35
11 - 802				
11 12 . . Cylinder Head				
New cylinder head height	mm	96.00 ± 0.03	96.00 ± 0.03	96.00 ± 0.07
Combustion chamber volume with valves and spark plugs	cm ³	43 ± 0.5		
11 12 . . Valve Guides				
Valve guide dia. - bore dia.				
Standard size	mm	12.00 x6 - 12.00 H7	12.00 x6 - 12.00 H7	12.00 x6 - 12.00 H7
Oversize 1	mm	12.20 x6 - 12.20 H7	12.20 x6 - 12.20 H7	12.20 x6 - 12.20 H7
Oversize 2	mm	12.40 x6 - 12.40 H7	12.40 x6 - 12.40 H7	12.40 x6 - 12.40 H7
Total length	mm	43.5 ± 0.2	45	45
Valve guide inside dia. (Installed)				
Standard size	mm	7.0 H7	7.0 H7	7.0 H7
Oversize 1	mm	7.1 H7	7.1 H7	7.1 H7
Oversize 2	mm	7.2 H7	7.2 H7	7.2 H7
Installing temperature				
Cylinders head	°C	+ 150	+ 150	+ 150
Valve guide	°C	- 150	- 150	- 150
Valve guide protrusion	mm	15	15	15

ENGINE

11 – 803

S 14

M 88 - 3

S 38

11 12 ... Valve Seat Inserts

Valve seat insert dia. – bore dia.
(distance "D")
Intake

Standard size	mm (in.)	40.15 g6 (1.581) – 40.00 H7 (1.575)
Oversize 0.2 mm (0.008")	mm (in.)	40.30 g6 (1.587) – 40.15 H7 (1.581)
Oversize 0.4 mm (0.016")	mm (in.)	40.45 g6 (1.592) – 40.30 H7 (1.587)

Exhaust

Standard size	mm (in.)	36.15 g6 (1.423) – 36.00 H7 (1.417)
Oversize 0.2 mm (0.008")	mm (in.)	36.45 g6 (1.435) – 36.30 H7 (1.429)
Oversize 0.4 mm (0.016")	mm (in.)	36.75 g6 (1.447) – 36.60 H7 (1.441)

Valve seat insert height – bore depth
(distance "H")

Standard size	mm (in.)	7.00 ± 0.02 (0.2756 ± 0.0008) – 7.20 ± 0.01 (0.2835 ± 0.0004)
Oversize 0.2 mm (0.008")	mm (in.)	7.15 ± 0.02 (0.2815 ± 0.0008) – 7.35 ± 0.01 (0.2837 ± 0.0004)
Oversize 0.4 mm (0.016")	mm (in.)	7.30 ± 0.02 (0.2874 ± 0.0008) – 7.50 ± 0.01 (0.2953 ± 0.0004)

Installing temperature

Valve seat insert	°C (°F)	- 150 (- 240)
Cylinder head	°C (°F)	+ 150 (+ 300)

ENGINE	S 14	M 88 3	S 38
11 - 804			

11 12 . Valve Seats			
Valve seat angle	°	45	
Correction angle:	°	35 / 60	
Valve seat width (distance "B")			
Intake	mm (in.)	1.2 \pm 0.1 (0.047 \pm 0.004)	
Exhaust	mm (in.)	1.4 \pm 0.1 (0.055 \pm 0.004)	
Valve seat dia. (distance "V")			
Intake	mm (in.)	38.6 \pm 0.1 (1.441 \pm 0.004)	
Exhaust	mm (in.)	31.4 \pm 0.1 (1.236 \pm 0.004)	

ENGINE

11 – 805

S 14

M 88 - 3

S 38

11 12 ... Timing Case

Camshaft bearings:

Bore diameter

mm (in.)

 30 ± 0.029
 ± 0.007 (1.1811 ± 0.0008)

Bucket tappets:

Bore diameter

mm (in.)

 37.5 ± 0.016
 (1.4764 ± 0.0006)
 35.0 ± 0.016
 (1.3779 ± 0.0006)
 37.5 ± 0.016
 (1.4764 ± 0.0006)

Tappet clearance

mm (in.)

0.025 to 0.066 (0.0010 to 0.0026)

ENGINE

11 – 806

S 14

M 88-3

S 38

11.21 Crankshaft and Bearings

– Double Classification –

Ground sizes of main bearing journals				
Standard size	red	mm (in.)	55.00 \pm 0.028 (2.1653)	60.00 \pm 0.028 (2.3622 \pm 0.0008)
	blue	mm (in.)	55.00 \pm 0.029 (2.1653)	60.00 \pm 0.029 (2.3622 \pm 0.0011)
Undersize 1 0.25 mm (0.010")	red	mm (in.)	54.75 \pm 0.028 (2.1555)	59.75 \pm 0.028 (2.3523 \pm 0.0008)
	blue	mm (in.)	54.75 \pm 0.029 (2.1555)	59.75 \pm 0.029 (2.3523 \pm 0.0011)
Undersize 2 0.50 mm (0.020")	red	mm (in.)	54.50 \pm 0.028 (2.1457)	59.50 \pm 0.028 (2.3425 \pm 0.0008)
	blue	mm (in.)	54.50 \pm 0.029 (2.1457)	59.50 \pm 0.029 (2.3425 \pm 0.0011)
Undersize 3 0.75 mm (0.030")	red	mm (in.)	54.25 \pm 0.028 (2.1358)	59.25 \pm 0.028 (2.3317 \pm 0.0008)
	blue	mm (in.)	54.25 \pm 0.029 (2.1358)	59.25 \pm 0.029 (2.3317 \pm 0.0011)
Radial crankshaft bearing play	mm (in.)	0.03 to 0.07 (0.0012 to 0.0027)		

ENGINE

11 – 807

S 14

M 88-3

S 38

11.21 Crankshaft and Bearings

– Triple Classification –

Ground sizes of main bearing journals				
Standard size	yellow	mm (in.)	54.984 to 54.990 (2.1647 to 2.1649)	59.984 to 59.990 (2.3616 to 2.3618)
	green	mm (in.)	54.977 to 54.983 (2.1644 to 2.1647)	59.977 to 59.983 (2.3613 to 2.3615)
	white	mm (in.)	54.971 to 54.976 (2.1642 to 2.1644)	59.971 to 59.976 (2.3610 to 2.3612)
Undersize 1 0.25 mm (0.010")	yellow	mm (in.)	54.734 to 54.740 (2.1549 to 2.1551)	59.734 to 59.740 (2.3517 to 2.3520)
	green	mm (in.)	54.727 to 54.733 (2.1546 to 2.1548)	59.727 to 59.733 (2.3514 to 2.3517)
	white	mm (in.)	54.721 to 54.726 (2.1544 to 2.1546)	59.721 to 59.726 (2.3512 to 2.3514)
Undersize 2 0.50 mm (0.020")	yellow	mm (in.)	54.484 to 54.490 (2.1450 to 2.1453)	59.484 to 59.490 (2.3419 to 2.3421)
	green	mm (in.)	54.477 to 54.483 (2.1447 to 2.1450)	59.477 to 59.483 (2.3416 to 2.3418)
	white	mm (in.)	54.471 to 54.476 (2.1445 to 2.1447)	59.471 to 59.476 (2.3414 to 2.3416)
Undersize 3 0.75 mm (0.030")	yellow	mm (in.)	54.234 to 54.240 (2.1352 to 2.1354)	59.234 to 59.240 (2.3320 to 2.3323)
	green	mm (in.)	54.227 to 54.233 (2.1349 to 2.1351)	59.227 to 59.233 (2.3318 to 2.3320)
	white	mm (in.)	54.221 to 54.226 (2.1347 to 2.1349)	59.221 to 59.226 (2.3315 to 2.3317)
Radial crankshaft bearing play		mm (in.)	0.020 to 0.046 (0.0008 to 0.0018)	

ENGINE

11 – 808

S 14

M 88-3

S 38

11 21 . . Crankshaft and Bearings

Ground sizes of crankshaft thrust bearing

Standard size mm (in.)

 $30.0 \begin{smallmatrix} +0.064 \\ +0.025 \end{smallmatrix}$ (1.1811 $\begin{smallmatrix} +0.0025 \\ +0.0010 \end{smallmatrix}$)

Oversize 1 mm (in.)

 $30.2 \begin{smallmatrix} +0.064 \\ +0.025 \end{smallmatrix}$ (1.1890 $\begin{smallmatrix} +0.0025 \\ +0.0010 \end{smallmatrix}$)

Oversize 2 mm (in.)

 $30.4 \begin{smallmatrix} +0.064 \\ +0.025 \end{smallmatrix}$ (1.1968 $\begin{smallmatrix} +0.0025 \\ +0.0010 \end{smallmatrix}$)

Oversize 3 mm (in.)

 $30.6 \begin{smallmatrix} +0.064 \\ +0.025 \end{smallmatrix}$ (1.2047 $\begin{smallmatrix} +0.0025 \\ +0.0010 \end{smallmatrix}$)

Axial crankshaft play mm (in.)

0.085 to 0.174 (0.0033 to 0.0068)

ENGINE	5 14	M 88-3	5 38
11 – 809			

11 21 ... Crankshaft and Bearings

Ground sizes of connecting rod bearing journals		
Standard size mm (in.)	47.975 to 47.991 (1.8888 to 1.8894)	
Undersize 1 / 0.25 mm (0.010") mm (in.)	47.725 to 47.741 (1.8789 to 1.8795)	
Undersize 2 / 0.50 mm (0.020") mm (in.)	47.475 to 47.491 (1.8691 to 1.8697)	
Undersize 3 / 0.75 mm (0.030") mm (in.)	47.225 to 47.241 (1.8592 to 1.8599)	
Radial control bearing play mm (in.)	0.03 to 0.07 (0.0012 to 0.0027)	

— Double Classification —

Ground sizes of connecting rod bearing journals		
Standard size mm (in.)	47.975 to 47.991 (1.8888 to 1.8894)	
Undersize 1 / 0.25 mm (0.010") mm (in.)	47.725 to 47.741 (1.8789 to 1.8795)	
Undersize 2 / 0.50 mm (0.020") mm (in.)	47.475 to 47.491 (1.8691 to 1.8697)	
Undersize 3 / 0.75 mm (0.030") mm (in.)	47.225 to 47.241 (1.8592 to 1.8599)	
Radial control bearing play mm (in.)	0.020 to 0.055 (0.0008 to 0.0022)	

ENGINE	S 14	M 60 / 3	a) S 38 B 36 b) S 38 B 36
11 – S10	a) M 3 b) 320 ls		

11 21 .. Crankshaft and Bearings

Max. imbalance of crankshaft (dynamic without flywheel)	gcm	10	25
Measuring planes		on main bearings 1 and 5 - center of bearing journal	on main bearings 1 and 7 - center of bearing journal
Take-up		on main bearings 1 and 5	on main bearings 1 and 7
Balancing speed	rpm	500	
Max. runout on center main bearing journal (crankshaft running on outer bearing journals)	mm (in.)	0.1 (0.004)	
Crankshaft throw	mm (in.)	a) 84.0 \pm 0.1 (3.307 \pm 0.004) b) 72.8 \pm 0.1 (2.868 \pm 0.004)	a) 84 \pm 0.1 (3.307 \pm 0.004) b) 86 \pm 0.1 (3.386 \pm 0.004)
Max. surface finish of bearing journals	Rt (μ)	2	

ENGINE	5 14	M 88-3	5 38
11 – 811			

11 22 Flywheel

Max. axial runout measured on outside diameter	mm (in.)	0.1 (0.004)	
Min. flywheel thickness (distance "A")	mm (in.)	29.1 ± 0.1 (1.145 ± 0.004)	28.6 ± 0.1 (1.047 ± 0.004)

11 23 ... Vibration Damper			
Max. radial runout	mm (in.)	0.3 (0.012)	0.2 (0.008)
Max. axial runout	mm (in.)	0.3 (0.012)	0.4 (0.016)
Diameter	mm (in.)	122 (4.803)	245 (9.646)
Color		—	white

ENGINE	S 14	M 88-3	S 38
11 – 812			

11.24 .. Connecting Rods and Bearings

Big conrod end bore dia.	mm (in.)	52.000 to 52.010 (2.0472 to 2.0476)
– Double Classification –		
Big conrod end bore diameter		
Red	mm (in.)	52.000 to 52.008 (2.0472 to 2.0475)
Blue	mm (in.)	52.009 to 52.016 (2.0476 to 2.0479)
Conrod bush – outside dia	mm (in.)	24.000 to 24.021 (0.9449 to 0.9457)
inside dia	mm (in.)	22.020 to 22.024 (0.8669 to 0.8671)
Max. deviation in parallel of conrod bores with bearing shells at distance of 150 mm (5.905")	mm (in.)	0.04 (0.0016)
Max. displacement to one side	°	0° 30'
Max. deviation in weight of all connecting rods in one engine (without bearing shells)	g	± 4
Big end	g	± 2
Small end	g	± 2

ENGINE 11 – 813	§ 14	M 88-3	§ 39
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11 25 . Pistons		Pistons and pins are matched – only replace them together in pairs.	
Weight class (die-stamped or engraved)		+ or – (weight difference of individual pistons max. 10 grams)	
Identification on piston		piston diameter, installed direction arrow, compression ratio	
Piston dia. (checkpoint "A")			
Standard size	mm (in.)	93.35 (3.675)	
Intermediate size	mm (in.)	93.40 (3.677)	
Oversize 1	mm (in.)	93.55 (3.683)	
Oversize 2	mm (in.)	93.75 (3.691)	
Piston running clearance	mm (in.)	0.03 to 0.05 (0.0012 to 0.0024)	
Max. total wear clearance between piston and cylinder (used engine)	mm (in.)	0.15 (0.006)	

ENGINE	S 14	M 88/3	S 38 B 34
11 - B14			S 38 B 34

11 25 .. Piston Rings

Groove 1 (plain compression ring)			
Height	mm	1.5	<div>- 0.010</div> <div>+ 0.022</div>
End clearance	mm	0.30 ... 0.55	
Side clearance	mm	0.05 - 0.09	
Groove 2 (tapered face compression ring)			
Height	mm	1.5	<div>- 0.010</div> <div>+ 0.022</div>
End clearance	mm	0.30 - 0.55	
Side clearance	mm	0.05 - 0.09	
Groove 3 (bevelled oil scraper ring with spring)			
Height	mm	<div>3.0</div> <div>- 0.010</div> <div>+ 0.022</div>	<div>* 2.5</div> <div>- 0.010</div> <div>+ 0.022</div>
End clearance	mm	0.25 - 0.50	
Side clearance	mm	0.02 ... 0.05	

ENGINE		S 14	M 88 / 3	a) S 38 B 35 b) S 38 B 36
11 - 815		a) M 3 a*) M 3-E 2		
11 31 ... Camshaft				
Drive		double roller chain	single roller chain	double roller chain
Camshaft bearing dia.	mm (In.)		30 - 0.020 (1.1811 - 0.0008) - 0.003 + 0.0013	
Camshaft bearing play				
Radial	mm (In.)		0.027 to 0.053 (0.0011 to 0.0021)	
Axial	mm (In.)		0.1 to 0.15 (0.004 to 0.006)	
Cam dimension "N"				
Intake	mm (In.)	a) 43.71 (1.721) a*) 44.10 (1.736)	41.84 (1.647)	a) 43.71 (1.721) b) 44.10 (1.736)
Exhaust	mm (In.)	a) 43.71 (1.721) a*) 43.71 (1.721)	41.84 (1.647)	a) 43.71 (1.721) b) 44.10 (1.736)

ENGINE		S 14	M 88 3	S 38
11 — R18				
11 31 . . Chain Tensioner				
Relaxed spring length	mm (in.)	150 ± 0.5 (6.280 ± 0.020)		
Chain tensioner piston dia.				
Stage 1	mm (in.)	19.462 to 19.468 (0.7662 to 0.7664)		
Stage 2	mm (in.)	19.468 to 19.474 (0.7664 to 0.7667)		
Chain tensioner cylinder dia.				
Stage 1	mm (in.)	19.500 to 19.507 (0.7677 to 0.7680)		
Stage 2	mm (in.)	19.507 to 19.513 (0.7680 to 0.7682)		

ENGINE		S 14	M 88 / 3	a) S 38 B 35 b) S 38 B 36
11 – 817				
11 34 ... Valves				
Intake and exhaust valve clearance				
At max. 35° C (95° F) coolant temperature	mm (in.)	0.26 to 0.35 (0.010 to 0.014)	0.3 to 0.35 (0.012 to 0.014)	a) 0.30 to 0.35 (0.012 to 0.014) b) 0.28 to 0.33 (0.011 to 0.013)
At operating temperature (thermostat activated)	mm (in.)	0.34 to 0.39 (0.013 to 0.015)	0.35 to 0.4 (0.014 to 0.016)	
Min. valve head edge thickness, machining limit (distance "A")				
Intake	mm (in.)		0.50 (0.020)	
Exhaust	mm (in.)		0.55 (0.022)	
Valve head dia. (distance "T")				
Intake	mm (in.)		37 - 0.1 (1.457 - 0.004)	
Exhaust	mm (in.)		32 - 0.1 (1.260 - 0.004)	
Valve stem dia. (distance "S")				
Standard size	mm (in.)		7.0 (0.275)	
Oversize 1	mm (in.)		7.1 (0.279)	
Oversize 2	mm (in.)		7.2 (0.283)	
Max. wear clearance between valve stem and valve guide (fit clearance "K")				
Intake	mm (in.)		0.65 (0.025)	
Exhaust	mm (in.)		0.60 (0.024)	

ENGINE 11 – 818	S 14	M 88 / 3	a) S 38 B 35 b) S 38 B 36
11 40 ... Oil Supply			
Lubricating system Oil grade	forced oil circulation with pressure control valve in filtered oil circuit see Service Information of Gr 00		
Oil change volume With oil filter	ltr. (US/imp. pts.)	4.4 (9.3 / 7.7)	5.75 (12.1 / 10.1)
Without oil filter	ltr. (US/imp. pts.)	4.1 (8.7 / 7.2)	5.0 (10.6 / 8.8)
Additionally for repairs after draining oil cooler	ltr. (US/imp. pts.)	0.55 (1.2 / 1.0)	0.75 (1.6 / 1.3)
11 41 ... Oil Pump			
Design	Eaton rotor-type pump		
Oil pressure at idle speed	bar (psi)	0.5 to 2.0 (7 to 28)	
Oil pressure at top speed	bar (psi)	4.0 to 6.0 (57 to 85)	
			a) 4.0 to 6.0 (57 to 85) b) 3.0 to 4.0 (43 to 57)

ENGINE	S 14	M 88 - 3	a) S 38 B 36 b) S 38 B 36
11 - 819			

11 52 ... Fan Clutch

Design		temperature and speed controlled visco fan clutch	
Switching-on temperature	°C (°F)	99 ± 4 (194 ± 7)	82 ± 4 (180 ± 7)
Switching-off temperature	°C (°F)	≥ 45 (113)	≥ 50 (140)
Fan blade dia.	mm (in.)	400 (15.748)	420 (16.535)
Number of fan blades		8	9
Fan speed at engine speed of 3,500 rpm (clutch switched on)	rpm	2000 ± 100	2400 ± 100

11 53 ... Thermostat (Coolant)

Opening temperature (stamped in thermostat)	°C (°F)	approx. 80 (175)	a) 80 (175) b) 79 (174)
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ENGINE ELECTRICAL EQUIPMENT		1 Series E 30	3 Series E 35	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 - 1							
12 11 ... Distributor							
Code		316. 0 237 005 010 316 Low Compression. GR, YU 0 237 005 009					
High tension distributor for DME							
Coil resistance	KΩ	1.1 ± 10 %	1.1 ± 10 %	1.1 ± 10 %	1.1 ± 10 %	1.1 ± 10 %	1.1 ± 10 %
Clearance between stator and rotor teeth	mm	0.3 ... 0.7	0.3 ... 0.7	0.3 ... 0.7	0.3 ... 0.7	0.3 ... 0.7	0.3 ... 0.7

ENGINE ELECTRICAL EQUIPMENT		3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 - 2							
12 12 ... Distributor							
Resistors in Secondary Circuit							
Angled plugs/shielded plugs	KΩ	1 ± 20 %					
Spark plug connectors	KΩ	5 ± 10 %					
Ignition lead at 20° C	mΩ/m	20					
Distributor rotor	KΩ	1 ± 30 %					
Position sender							
Coil resistance	Ω	80 ± 10 %					

ENGINE ELECTRICAL SYSTEM

S 14

S 30

S 50

S 70

12 - 3

12 12 ... Spark Plugs

Designation

Bosch X5 DTC

Bosch Y6 DC

Bosch Y5 DDC

Bosch F8 LCR2

US:

Bosch X5 DC

12 - 4 Engine electrical system

M 10

M 20

M 30

12 12 ... Spark plugs

Designation

Bosch W8 DC

Further information:
See

Service Information
Group 12
Engine electrical
systems
Spark plugs
All models

B 20:

Bosch W8 LCR
Bosch W8 LPR

B 25:

up to 12/86
Bosch W7 DCR

from 12/86
Bosch W8 LCR
Bosch W8 LPR

B 27:

up to 12/86
Bosch W9 LC

from 12/86
Bosch W8 LCR
Bosch W8 LPR

B 27 US

Bosch WR9 LS
Further information:
See
Service Information
Group 12

Bosch W8 DC

with DME:
Bosch W8 LCR
Bosch W8 LPR

12 - 5 Engine electrical system

M 40

M 42

M 43

M 50

12 12 ... Spark plugs

Designation

E 30:
Bosch F8 LCR

E 36:
Bosch F04 DAR
NGK BCPR 6ER

E 30:
NGK BCPR 7ER

E 36:
Bosch F7 LDCR

E 30 US:
NGK BCPR 6ER

E 36 US:
Bosch F7 LDCR

Bosch F7 LDCR

up to 1992
Bosch F03 DAR
NGK BCPR 7ER

from 1992
NGK BKR 6EK

US:
up to 1991
NGK BCPR 7ER

from 1991
Bosch F04 DAR

12 - 7 Engine electrical system

3 Series E 30

3 Series E 36

5 Series E 34

6 Series E 24

7 Series E 32

8 Series E 31

12 12 Ignition components, spark plugs

Designation

Further information.
Consult most recent Service
Information:

Electrode gap	mm	3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
		0,7 ^{+0,1} <i>M models:</i> 0,6 ^{+0,1}	0,7 ^{+0,1}	0,7 ^{+0,1} <i>M models:</i> 0,6 ^{+0,1}	0,7 ^{+0,1} <i>M models:</i> 0,6 ^{+0,1}	0,7 ^{+0,1}	0,7 ^{+0,1}
		with triangle ground electrode: 0,9 ^{+0,1}	with triangle ground electrode: 0,9 ^{+0,1}	with triangle ground electrode: 0,9 ^{+0,1}			

Firing order

4 cylinder 1, 3, 4, 2

6 cylinder 1, 5, 3, 6, 2, 4

8 cylinder 1, 5, 4, 8, 6, 3, 7, 2

12 cylinder 1, 7, 5, 11, 3, 9
6, 12, 2, 8, 4, 10

12 - 8 Engine electrical system		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 12... Ignition components, spark plugs							
Cylinder recognition sensor							
Coil resistance at 20° C	Pin 1 and 2 Ω	< 1	< 1	< 1	< 1	< 1	< 1
	Pin 2 and Pin 3 MΩ	> 10	> 10	> 10	> 10	> 10	> 10
12 13... Ignition coil							
Primary winding resistance	Ω	0.82	0.82	a) 0.5 b) 0.37	a) 0.5 b) 0.37	a) 0.5 b) 0.37	a) 0.5 b) 0.37
Secondary winding resistance	KΩ	8.25	8.25	a) 6.0 b) 9.0	a) 6.0 b) 9.0	a) 6.0 b) 9.0	a) 6.0 b) 9.0
Primary inductance	mH	5.8	5.8	a) 3.7 b) 5.8	a) 3.7 b) 5.8	a) 3.7 b) 5.8	
Secondary inductance	H	31	31	a) 31 b) 44	a) 31 b) 44	a) 31 b) 44	
Ignition coil for stationary voltage distribution		M 42	M 50, M 42, M 43M 50, M 60			M 60	
Primary winding resistance	Ω	ca. 0.8	ca. 0.8	ca. 0.8		ca. 0.8	
Secondary winding resistance		n.a.	n.a.	n.a.		n.a.	

12 - 9 Engine electrical system		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 14 . . . Pulse sensor (DME)							
Coil resistance at 20° C							
	Ω	540 ± 10 %	540 ± 10 %	540 ± 10 %	540 ± 10 %	540 ± 10 %	540 ± 10 %
		M models:		M models:	M models:		
	Ω	960 ± 10 %		960 ± 10 %	960 ± 10 %		
		M 42 (stationary voltage distribution):	M 50, M 42, M 43 (stationary voltage distribution):	M 50, M 60 (stationary voltage distribution)		M 60 (stationary voltage distribution):	
	Ω	1280 ± 10 %	1280 ± 10 %	1280 ± 10 %		1280 ± 10 %	
Gap:							
Inductive pulse sensor/teeth wheel							
	mm	1.0 ± 0.3	1.0 ± 0.3	1.0 ± 0.3	1.0 ± 0.3	1.0 ± 0.3	1.0 ± 0.3
		M 3 (Ev. 10)					
	mm	1.6 ± 0.3					

ENGINE ELECTRICAL SYSTEM		3 Series E 30 3 Series E 36	5 Series E 34
12 - 10			
12 21 ... Heating Time Control Unit			
Max. heating time with coolant temperature Below 60° C	sec.	M 21: 5 / M 51: 5	M 21: 5 / M 51: 5
Above 60° C	sec.	0	0
Safety switch-off after	sec.	8 + 5	8 + 5
Glow plug fuse	A	80	80
12 23 ... Glow Plugs			
Testing voltage	V	12 ± 0.5	12 ± 0.5
Max. current consumption of one glow plug after approx. 5 sec. operation	A	13 ... 15	13 ... 15
after approx. 20 sec. operation	A	12	12
Temperature after about 5 sec. operation	° C	approx. 500	approx. 500
Glow plug resistance at 20° C	Ω	0.4 ... 0.6	0.4 ... 0.6
Current consumption of all glow plugs at 20° C measured with current clips of BMW Service Tester	A	60 ... 80	60 ... 80

ENGINE ELECTRICAL SYSTEM		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
12 - 11							
12 31 ... Alternator							
Rated voltage	V	14					
Rated current / power	A / W	65 / 910 60 / 1120 60 / 1260 105 / 1470 115 / 1610 140 / 1960					
Shielded capacitor							
Capacitance	μF	2.2 \pm 20 %					

12 - 12 Engine electrical system		3 Series E 30	3 Series E 38	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 32 . . . Voltage regulator							
Regulated voltage at 1500 rpm Engine speed/ no electrical devices on	V	13.5 ... 14.2 (at 30° C to 60° C at regulator)	13.5 ... 14.2 (at 30° C to 60° C at regulator)	13.5 ... 14.2 (at 30° C to 60° C at regulator)	13.5 ... 14.2 (at 30° C to 60° C at regulator)	13.5 ... 14.2 (at 30° C to 60° C at regulator)	13.5 ... 14.2 (at 30° C to 60° C at regulator)
Constant voltage regulator (vehicles with battery in trunk or below rear seat only)					14.3 ± 0.1V	14.3 ± 0.1V	
12 41 . . . Starter							
Rated output	KW	M 42: 1.4 M 40: 1.4 M 19: 1.1 M 20: 1.4 M 21: 2.2 S 14: 1.4	M 40: 1.4 M 42: 1.4 M 43: 1.4 M 50: 1.7 S 50: 1.4	M 20: 1.4 M 30: 1.7 M 21: 2.2 M 50: 1.7 S 38: 1.7 M 60: 1.7	M 30: 1.5 M 30: 1.7	M 30: 1.5 M 30: 1.7 M 70: 2.2 M 60: 1.7	M 70: 2.2 M 60: 1.7
Armature endfloat	mm	0.1 ... 0.2	0.1 ... 0.2	0.1 ... 0.2	0.1 ... 0.2	0.1 ... 0.2	0.1 ... 0.2
Carbon brush length	min. mm	13	13	13	13	13	13
Test voltage	V	12 ± 0.3	12 ± 0.3	12 ± 0.3	12 ± 0.3	12 ± 0.3	12 ± 0.3

ENGINE ELECTRICAL SYSTEM		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 - 13							
12 41 ... Solenoid Switch							
Current consumption at term. 50 (with rated voltage)							
With rated power of 1.1 ... 1.7 KW							
Pull-in winding	A	40					
Hold-in winding	A	7.5					
With rated power of 2.2 KW							
Pull-in winding	A	60					
Hold-in winding	A	10					

ENGINE ELECTRICAL SYSTEM		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
12 - 14							
12 61 ... Oil Pressure Switch							
Switch-on pressure		bar					
		0.2 ... 0.5					
Oil Level Switch							
Note:							
Max. 200 mA testing load.							
Measured against vehicle ground							
Level okay		1 k Ω \pm 1 %					
Static at connection 1							
Level too low		0 ... 0.2 Ω					
Level okay		0 ... 0.2 Ω					
Dynamic at connection 2							
Level too low		∞ Ω					

ENGINE ELECTRICAL SYSTEM		3 Series E 30	5 Series E 34
12 - 15			
12 62 ... Coolant Temperature Sender			
Coolant temperature resistance between conn. G 1 and ground at 60° C	- G 1 Ω	M 21 134 ± 13.5	M 21 134 ± 13.5
	at 90° C - G 2 Ω	51.2 ± 4.3	51.2 ± 4.3
12 62 ... Heating Time Control			
Heating time control resistance between conn. G 2 and ground at 20° C	Ω	M 21 1134 ± 125	M 21 1134 ± 125
	at 60° C Ω	272 ± 27	272 ± 27
	at 90° C Ω	114 ± 11	114 ± 11

ENGINE ELECTRICAL SYSTEM

12 - 16

3 Series E 30

5 Series E 34

12 63 . Temperature Sender for Cold Start Aid

		M 21	M 21
Operating voltage	V	9 ... 15	9 ... 15
Switch-off temperature	° C	17 ± 2	17 ± 2
Switch-on temperature	° C	11 ... 14	11 ... 14
Fuel Preheating Temperature Switch 5.5° C		M 21	M 21
Switch-on temperature (with dropping temperature)	° C	5.5 ± 2.5	5.5 ± 2.5
Switch-off temperature (with rising temperature)	° C	- 0.5 ± 2.5	- 0.5 ± 2.5

ENGINE ELECTRICAL SYSTEM		3 Series E 30	5 Series E 34
12 - 17			
12 64 ... Fuel Filter Heater			
Current consumption of heating element 5 seconds after switching on		<i>M 21</i>	<i>M 21</i>
	A	9 ± 2	9 ± 2
Testing voltage	V	12 ± 0.5	12 ± 0.5
Current consumption with max. heating output		<i>M 51</i>	<i>M 51</i>
	A	12.5 ± 1	12.5 ± 1
Testing voltage	V	12 ± 0.5	12 ± 0.5

[illegible]

FUEL SYSTEM	Engine Type	Model	Engine Code on Data Plate	Idling Speed in RPM	CO In % by Volume*	1)	2)	3)	4)
13 - 41								Month/Year	RPM

1.3. Dm General Instrumental Use

	M30B18	5161 / A	18 4E 1	800 ± 40	0.7 ± 0.5	+0	-/+	9/88	6200
	M30B20	5201 / A	20 6K A	760 ± 40	0.7 ± 0.5	+0	-/+	4/88	6400
	M50B20	5201 / A	20 6S 1	800 ± 40	0.7 ± 0.5**	+0	-/+	4/90	6500
	M50B20	5301 / A	30 6S 1	700 ± 40	0.7 ± 0.5**	+0	-/+	9/90	6500
	M30B25	5251 / A	25 6K 1	760 ± 40	0.7 ± 0.5	+0	-/+	4/88	6400
	M50B25	5251 / A	25 6S 1	800 ± 40	0.7 ± 0.5**	+0	-/+	4/90	6500
	M50B25	5351 / A	25 6S 1	700 ± 40	0.7 ± 0.5**	+0	-/+	9/90	6500
	M30B30	5301 / A	30 6K A	800 ± 50	0.7 ± 0.5	+0	-	4/88	6400
	M50B30	5301 / A	30 6S 1	600 ± 50	0.7 ± 0.5	+0	-/+	5/92	6400
	M30B35	5351 / A	34 6K B	800 ± 50	0.7 ± 0.5	+0	-	4/88	6200
	M50B40	5401 / A	40 6S 1	600 ± 50	0.7 ± 0.5	+0	-/+	5/92	6400
	S36B36	M5	36 6S 1	890 ± 50	0.8 ± 0.4	+	+	9/88	7250
	S36B36	M5	36 6S 2	870 ± 40	0.8 ± 0.4	+	+	7/88	7250
	S36B38	M5	38 6S 1	920 ± 50	0.8 ± 0.4	+	+	9/92	7250
1)	+ = With catalytic converter - = Without catalytic converter o = Prepared for catalytic converter								
	M30B35	63SCSI/A	34 6E C	800 ± 50	1.0 ± 0.5	-	+	9/87	6200
	M30B35	63SCSI/A	34 6K B	800 ± 50	0.7 ± 0.5	+0	-	9/87	6200
	S36B36	M63SCSI	35 6E Y	850 ± 50	1.0 ... 1.5	-	+	6/87	6800
2)	CO can be adjusted: + = Yes = = No								
	S36B36	M63SCSI	35 6E E	800 ± 50	0.8 ± 0.4	+	+	6/87	6800
3)	Manufactured since								
d)	Shutoff speed (up to 6400 ± 40 rpm from 6400 ± 80 rpm)								
*	Measured in front of catalyst in cars with catalytic converter								
**	0.5 - 1.5 in cars prepared for catalytic converter								

FUEL SYSTEM

13 - 43

Engine Type

Part Number

Code

Since
(Month/Year)

13 41 ... Idling Speed Control

M40B16	1 709 932	0 260 140 519	
M40B16	1 737 797	0 260 140 529	5/90
M40B18	1 709 932	0 260 140 519	
M40B18	1 737 797	0 260 140 529	5/90
M42B18	1 709 932	0 260 140 519	
M42B18	1 737 797	0 260 140 529	5/90
M20B20	1 286 065	0 260 140 509	9/94
M20B20	1 726 209	0 260 140 524	6/98
M20B25	1 286 065	0 260 140 509	
M20B25	1 726 209	0 260 140 524	6/98
M20B27	1 286 065	0 260 140 509	12/96
M20B27	1 726 209	0 260 140 524	6/98
M50B30	1 726 209	0 260 140 524	
M50B30	1 748 905*	0 260 140 532	6/92
M50B35	1 726 209	0 260 140 524	
M50B35	1 738 981		6/92
S14B23	1 286 065	0 260 140 509	
S50B30	1 733 090	0 260 140 532	10/92
M30B30	1 286 065	0 260 140 509	
M30B35	1 286 065	0 260 140 509	
M60B30	1 733 090	0 260 140 532	4/92
M60B40	1 733 090	0 260 140 532	5/92
S38B35	1 286 065	0 260 140 509	
S38B36	1 286 065	0 260 140 509	
S38B38	1 733 090	0 260 140 532	11/91

* For M540 DME

FUEL SYSTEM	Engine Type	Part Number	Code	Rated Pressure (bar)
13 - 44				

13 53 ... Pressure Regulator

M40B16	1 715 114	0 280 160 285	3.0 ± 0.06
M40B16	1 715 114	721 19 711	3.0 ± 0.06
M40B16	1 721 992/1 729 320	0 280 160 503	3.0 ± 0.06
M40B18	1 715 114	0 280 160 285	3.0 ± 0.06
M40B18	1 721 992/1 729 320	0 280 160 503	3.0 ± 0.06
M40B18	1 715 114	712 19 711	3.0 ± 0.06
M42B18	1 721 992	0 280 160 503	3.0 ± 0.06
M42B18	1 747 078	0 280 160 503	3.0 ± 0.06
M30B20	1 711 540	0 280 160 248	2.5 ± 0.05
M30B25	1 711 541	0 280 160 249	3.0 ± 0.06
M50B20	1 721 992	0 280 160 503	3.0 ± 0.06
M50B20	1 747 078	0 280 160 503	3.0 ± 0.06
M50B25	1 726 285	0 280 160 504	3.5 ± 0.06
M50B25	1 731 615	0 280 160 504	3.5 ± 0.06
S14B23	1 284 897	0 280 160 226	3.0 ± 0.06
S50B30	1 715 685	0 280 160 500	3.0 ± 0.06
M30B30	1 711 541	0 280 160 249	3.0 ± 0.06
M30B35	1 711 541	0 280 160 249	3.0 ± 0.06
M50B30	1 731 615	0 280 160 504	3.5 ± 0.06
M50B30	1 731 615	7,21 548,01	3.5 ± 0.06
M50B40	1 731 615	0 280 160 504	3.5 ± 0.06
M50B40	1 731 615	7,21 548,01	3.5 ± 0.06
S38B35	1 711 541	0 280 160 249	3.0 ± 0.06
S38B36	1 715 685	0 280 160 500	3.0 ± 0.06
S38B38	1 731 615	0 280 160 504	3.5 ± 0.06
M70B50	1 715 685	0 280 160 500	3.0 ± 0.06
M70B50	1 725 625	7,21 548,00	3.0 ± 0.06

FUEL SYSTEM 13 - 45	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec.Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
DME M13					

13 61 ... Control Units

Model: 340 / A Engine Type: M40B16 Basic Control Unit Hardware No.: 1 721 427; 1 727 312; 1 734 179, 1 739 035, 1 739 653 (E30/S) Code: 0 261 200 174	C01E	ECE	HG	BN	with
	C21E	ECE	AG	BN	with
	F01E	ECE	HG	BN	prepared for
	F21E	ECE	AG	BN	prepared for
	E41E	Golf	HG	BN	without
	E61E	Golf	AG	BN	without

Model: 318i / A Engine Type: M40B18 Basic Control Unit Hardware No.: 1 717 605; 1 721 660; 1 721 743; 1 722 699; 1 727 009; 1 727 982, 1 727 679; 1 727 679; 1 727 734 (Japan) Code: 0 261 200 157; 0 261 200 367	C01E	ECE	HG	BN	with
	C21E	ECE/Japan	AG	BN	with
	F01E	ECE	HG	BN	prepared for
	F21E	ECE	AG	BN	prepared for
	E41E	Golf	HG	BN	without
	E61E	Golf	AG	BN	without

FUEL SYSTEM 13 - 46 DME M1.7	Version Code	Country Version	HG = Man. Transm AG = Autom. Transm. EH = Elec./Hydr. Transm	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13-61 ... Control Units					
Model: 316I / A Engine Type: M40B16 Basic Control Unit Hardware No.: 1 737 493; 1 734 709; 1 739 038; 1 739 534 Code: 0 261 200 522	C01E	ECE	HG	BN	with
	C21E	ECE	EH	BN	with
	F01E	ECE	HG	BN	prepared for
	F21E	ECE	EH	BN	prepared for
	E41E	Golf	HG	BN	prepared for
Model: 318I / A Engine Type: M40B18 Basic Control Unit Hardware No.: 1 737 491; 1 734 710; 1 739 039; 1 739 041; 1 739 108 (ECE) Code: 0 261 200 520	E61E	Golf	EH	BN	prepared for
	C01E	ECE	HG	BN	with
	C21E	ECE	EH	BN	with
	F01E	ECE	HG	BN	prepared for
	F21E	ECE	EH	BN	prepared for
Model: 318Is Engine Type: M42B18 Basic Control Unit Hardware No.: 1 721 720; 1 727 900; 1 734 060; 1 734 131; 1 734 689; 1 739 045 (US); 1 739 678 (US) Code: 0 261 200 175; 0 261 200 950	801E	ECE	HG	BS	with
	801E	ECE	HG	BS	prepared for
	801E	A/S/CH/AUS	HG	BS	with
Model: 318Is Engine Type: M42B18 Basic Control Unit Hardware No.: 1 734 901; 1 739 371; 1 739 423; 1 739 679 Code: 0 261 200 950	801E	ECE	HG	BS	with
	801E	ECE	HG	BS	prepared for

FUEL SYSTEM	Version Code	Country Version	HQ = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 47					
DME M1.1					

13 61 ... Control Units

Model: 320i / A	C05E	ECE	HQ	BN	with
Engine Type: M20B20	C25E	ECE	AG	BN	with
Basic Control Unit Hardwar No.:	C35E	ECE	EH	BN	with
1 714 997; 1 722 300	D01E	A	HQ	BN	with
	D21E	A	AG	BN	with
Code:	D31E	A	EH	BN	with
0 261 200 152	C81E	S/CH/AUS	HQ	BN	with
	CA1E	S/CH/AUS	AG	BN	with
	CB1E	S/CH/AUS	EH	BN	with
	CC9E	J	HQ	BN	with
	CE9E	J	AG	BN	with
	CF9E	J	EH	BN	with
Model: 320i / A	A05E	ECE	HQ	BS	prepared for
Engine Type: M20B20	A25E	ECE	AG	BS	prepared for
Basic Control Unit Hardwar No.:	A35E	ECE	EH	BS	prepared for
1 722 180; 1 722 420					
Code:					
0 261 200 163					

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 48					
DME M1.3					

13-61 ... Control Units

Model: 330i / A

Engine Type: M20B20

Basic Control Unit Hardware No :

1 722 366; 1 726 380; 1 726 942;

1 726 101; 1 726 682; 1 730 574;

1 730 573 (Conv.); 1 735 333 (Conv.);

1 735 363

Code:

0 261 200 172; 0 261 200 381

C05E	ECE	HG	BN	with
C25E	ECE	AG	BN	with
C35E	ECE	EH	BN	with
C41E	A	HG	BN	with
C41E	A	AG	BN	with
C81E	A	EH	BN	with
CC5E	J	HG	BN	with
CE5E	J	AG	BN	with
CF5E	J	EH	BN	with
A05E	ECE	HG	BS	prepared for
A25E	ECE	AG	BS	prepared for
A35E	ECE	EH	BS	prepared for
A45E	Golf	HG	BS	without
A65E	Golf	AG	BS	without
A75E	Golf	EH	BS	without

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 49					
DME M1.1					

13-61 — Control Units

Model: 325i / A Engine Type: M20B25 Basic Control Unit Hardware No.: 1 714 998; 1 722 210 Code: 0 260 200 153; 0 261 300 153; 0 261 300 164	C05E	ECE	HG	BN	with
	C25E	ECE	AG	BN	with
	C35E	ECE	EH	BN	with
	C85E	USA/CH/SIA/US	HG	BN	with
	C45E	USA/CH/SIA/US	AG	BN	with
	C95E	USA/CH/SIA/US	EH	BN	with
	CE5E	J	AG	BN	with
	CF5E	J	EH	BN	with
Model: 325i / A Engine Type: M20B25 Basic Control Unit Hardware No.: 1 722 180; 1 722 430 Code: 0 261 200 153; 0 261 300 164	A05E	ECE	HG	BS	prepared for
	A25E	ECE	AG	BS	prepared for
	A35E	ECE	EH	BS	prepared for
	A45E	GoS	HG	BS	without
	A65E	GoS	AG	BS	without
	A75E	GoS	EH	BS	without

FUEL SYSTEM	Version Code	Country Version	HC = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BH = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 50					
DME M1.1					

13 61 ... Control Units

Model: 325IX / A	C33E	ECE	HC	BN	with
Engine Type: M20B25	C23E	ECE	AG	BN	with
Basic Control Unit Hardware No.:	C33E	ECE	EH	BN	with
1 714 998, 1 722 210	C83E	US	HC	BN	with
	CA3E	US	AG	BN	with
Code:	C83E	US	EH	BN	with
0 260 200 153					
Model: 325IX / A	A33E	ECE	HC	BS	prepared for
Engine Type: M20B25	A23E	ECE	AG	BS	prepared for
Basic Control Unit Hardware No.:	A33E	ECE	EH	BS	prepared for
1 722 190; 1 722 430	A43E	Golf	HC	BS	without
	A63E	Golf	AG	BS	without
Code:	A73E	Golf	EH	BS	without
0 261 200 164					

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 51					
DME M1.3					

13-51 . . . Control Units

Model: 3151 / A Engine Type: M20B25 Basic Control Unit Hardware No: 1 712 159 Code: 0 261 200 173	C01E	ECE	HG	BN	with
	C21E	ECE	AG	BN	with
	C31E	ECE	EH	BN	with
	C81E	USA/CH/S/AUS	HG	BN	with
	CA1E	USA/CH/S/AUS	AG	BN	with
	C81E	USA/CH/S/AUS	EH	BN	with
	CE1E	J	AG	BN	with
	CF1E	J	EH	BN	with
 Model: Z1 Engine Type: M20B25 Basic Control Unit Hardware No.: 1 726 837, 1 730 524 Code: 0 261 200 385					
	C05E	ECE	HG	BN	with

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 52					
DME M1.3					

13 61 ... Control Units

Model: 325i / A	C05E	ECE	HG	BN	with
Engine Type: M20B25	C25E	ECE	AG	BN	with
Basic Control Unit Hardware No.:	C35E	ECE	EH	BN	with
1 722 269; 1 726 366; 1 726 102;	C45E	USA/CH/S/AUS	HG	BN	with
1 726 600; 1 726 683; 1 726 686;	C45E	USA/CH/S/AUS	AG	BN	with
1 730 523 (only AG); 1 730 529;	C65E	USA/CH/S/AUS	EH	BN	with
1 730 576; 1 730 527 (US);	C65E	J	AG	BN	with
1 735 364 (not US); 1 735 365	CF5E	J	EH	BN	with
Code:	A05E	ECE	HG	BS	prepared for
0 261 200 173; 0 261 200 340;	A25E	ECE	AG	BS	prepared for
0 261 200 362; 0 261 200 525 (US)	A35E	ECE	EH	BS	prepared for
	A45E	Golf	HG	BS	without
	A65E	Golf	AG	BS	without
	A75E	Golf	EH	BS	without

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 53					
DME M1.3					

13 61 ... Control Units

Model: 325IX / A	C03E	ECE	HG	BN	with
Engine Type: M20B25	C23E	ECE	AG	BN	with
Basic Control Unit Hardware No.:	C33E	ECE	EH	BN	with
1 732 268; 1 726 366; 1 726 600;	C63E	US	HG	BN	with
1 726 683 (Conv.); 1 730 529,	CA3E	US	AG	BN	with
1 730 575; 1 730 576; 1 726 367;	CB3E	US	EH	BN	with
1 726 686; 1 730 438; 1 730 523;	A03E	ECE	HG	BS	prepared for
1 730 528 (US); 1 735 368 (AG);	A23E	ECE	AG	BS	prepared for
1 735 366 (US)	A33E	ECE	EH	BS	prepared for
Code	A43E	GoH	HG	BS	prepared for
0 261 200 173; 0 261 300 351;	A63E	GoH	AG	BS	prepared for
0 261 200 380; 0 261 200 382	A47E	GoH	EH	BS	prepared for

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
13 - 54					
DME M3.1					

13 61 ... Control Units

Model: 325i / A	*	ECE	HG	BS	with
Engine Type: M50B20	*	ECE	HG	BS	prepared for
Basic Control Unit Hardware No.:	*	ECE	EH	BS	with
1 735 614; 1 730 784,	*	ECE	EH	BS	prepared for
1 738 376 Ratio I;					
1 738 931 Ratio II (not US);					
1 748 637 Ratio III					
1 748 401 Ratio IV					
Code:					
0 261 200 405					
* Version Code:					
See Parts Catalog					
Model: 325i / A	*	ECE	HG	BS	with
Engine Type: M50B25	*	ECE	HG	BS	prepared for
Basic Control Unit Hardware No.:	*	ECE	EH	BS	with
1 735 614; 1 730 784;	*	ECE	EH	BS	prepared for
1 738 376 Ratio I;					
1 738 931 Ratio II (not US);					
1 748 637 Ratio III					
1 748 401 Ratio IV					
Code:					
0 261 200 405					

* Version Code:
See Parts Catalog

FUEL SYSTEM	Version Code	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = unleaded regular BS = unl. prem. BSP = unleaded prem. plus S = leaded prem.	Catalytic Converter
13 - 69					

13-61 ... Control Units

DME M1.2					
Model: M5 (E 34)					
Engine Type: S38B38	801E	ECE	HG	BS	with
Basic Control Unit Hardware No.: 1 315 408; 1 316 941; 1 317 113	A01E	ECE	HG	BS	prepared for
Code:	881E	US	HG	BS	with
	B01E	ZA	HG	S	without
	B01E	Tropics	HG	S	without
0 261 200 350	B41E	Golf	HG	S	without
DME M3.3					
Model: M5 (E 34)					
Engine Type: S38B38	*	ECE	HG	BS	with
Basic Control Unit Hardware No.: 1 317 417	*	CH	HG	BS	with
Code: 0 261 200 412					
DME M3.3					
Model: M3 (E 36)					
Engine Type: S50B30	*	ECE	HG	BSP	with
Basic Control Unit Hardware No.: 1 317 808	*	SvCH	HG	BSP	with
Code: 0 261 203 075					

FUEL SYSTEM	Plug Code 0 = Opened 1 = Closed	Country Version	HG = Man. Transm. AG = Autom. Transm. EH = Elec./Hydr. Transm.	BN = Reg. Grade Unleaded BS = Prem. Grade Unleaded S = Prem. Grade Leaded	Catalytic Converter
DME	black/blue				

13 51 ... Control Units

Model: M3 / Convertible Engine Type: S14B23 Control Unit No.: 1 311 899; 1 312 777 (E2) Code: 0 261 200 071; 0 261 200 090 (E2)	1 / 1	ECE	HG	S	without
	0 / 1	ECE	HG	BS	with
	0 / 0	ECE	HG	BN	with
	1 / 0	USJ	HG	BS	with
Model: M3 / Convertible Engine Type: S14B23 Control Unit No.: 1 315 263 (E1) Code: 0 261 200 091 (E1)	1 / 1	ECE	HG	BS	without
	0 / 1	ECE	HG	BS	with
	0 / 0	CH	HG	BS	with
Model: 320is Engine Type: S14B20 Control Unit No.: 1 312 005 Code: 0 261 200 087	- / -	IT	HG	S	without

FUEL SYSTEM	Engine Type	Part Number	Code	Country Version	1) Color Code	Since (Month/Year)
13 - 73						

13 62 ... Air Flow Sensor

M40B16	1 714 502	0 280 200 201	ECE			3/88
M40B16	1 734 653	0 280 200 205	ECE			4/91
M40B18	1 714 503	0 180 202 203	ECE			
M40B18	1 734 657	0 280 202 135	ECE			4/91
M43B18	1 714 503	0 180 202 203	ECE			
M20B20	1 710 546	0 280 202 090	ECE	A		
M20B20	1 710 538	0 280 202 043	ECE			4/88
M20B20	1 710 545	0 280 202 083	ECE			3/87
M20B25	1 286 815	0 280 202 082	ECE	B		
M20B25	1 710 545	0 280 202 093	ECE			3/87
M20B25*	1 710 543	0 280 202 082	ECE			
S14B20	1 307 486	0 280 203 026	ECE			
S14B23	1 307 486	0 280 203 028	ECE	C		
M30B30	1 286 064	0 208 203 027	ECE	B		
M30B35	1 286 064	0 208 203 027	ECE	B		
S36B35	1 307 019	0 280 203 025	ECE			

* With cyclone separator

1) A = light blue
B = red
C = green

FUEL SYSTEM
13 - 75
Engine Type
Part Number
Code
Code
13-62 ... Coolant Temperature Sensor
Test Values:
 $at - 10 \pm 1^\circ C = 8.2 \dots 10.5 K\Omega$
 $at + 20 \pm 1^\circ C = 2.2 \dots 2.7 K\Omega$
 $at + 80 \pm 1^\circ C = 0.3 \dots 0.36 K\Omega$

M40B16	1 709 966	323 805/009/001	0 280 130 026
M40B18	1 709 966	323 805/009/001	0 280 130 026
M42B18	1 709 966	323 805/009/001	0 280 130 026
M20B20	1 709 966	323 805/009/001	0 280 130 026
M20B20	1 709 966	323 805/009/001	0 280 130 026
M70B20	1 709 966	323 805/009/001	0 280 130 026
M20B25	1 709 966	323 805/009/001	0 280 130 026
M50B20	1 709 966	323 805/009/001	0 280 130 026
M50B25	1 709 966	323 805/009/001	0 280 130 026
S14B23	1 709 966	323 805/009/001	0 280 130 026
S50B30	1 401 945		
M30B30	1 709 966	323 805/009/001	0 280 130 026
M30B30	1 709 966	323 805/009/001	0 280 130 026
M30B30	1 709 966	323 805/009/001	0 280 130 026
M30B35	1 709 966	323 805/009/001	0 280 130 026
M30B35	1 709 966	323 805/009/001	0 280 130 026
M30B35	1 709 966	323 805/009/001	0 280 130 026
M50B30	1 288 158		0 280 130 037
M60B40	1 288 158		0 280 130 037
S38B35	1 709 966	323 805/009/001	0 280 130 026
S38B36	1 709 966	323 805/009/001	0 280 130 026
S30B38			
M70B50	1 707 366		0 280 130 036*

FUEL SYSTEM

13 - 77

Engine Type	Part Number	Static Flow Rate approx. cm ³ /min.	1) Test Pressure bar	Coil Resistance approx. Ω at 20° C	Code	Plug Color	Approx. Ejection Angle
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13 S4 . . Fuel Injectors

M40B16	1 706 162	170	3.0 ± 0.05	15 ... 17.5	0380150715	blue	30
M40B18	1 706 162	170	3.0 ± 0.05	15 ... 17.5	0280150715	blue	30
M40B16	1 734 776	170	3.0 ± 0.05	15 ... 17.5	0280150715	blue	30
M40B16	1 734 776	170	3.0 ± 0.05	15 ... 17.5	0380150715	blue	30
M40B16	1 731 357	170	3.0 ± 0.05		D 3762 FA	blue	
M40B18	1 731 357	170	3.0 ± 0.05		D 3762 FA	blue	
M42B18	1 706 176	220	3.0 ± 0.05	15 ... 17.5	0280150714	yellow	30
M42B18	1 726 983*	220	3.0 ± 0.05	15 ... 17.5	0380150714	yellow	30
M42B18	1 739 242	220	3.0 ± 0.05		D 3761 FA	orange	
S14B20	1 273 272	235	3.0 ± 0.05	2 ... 3	0280150201	gray	30
S14B23	1 273 272	235	3.0 ± 0.05	2 ... 3	0280150201	gray	30
M50B20	1 310 641	270	3.0 ± 0.05		0380150701	ivory	30
M20B20	1 706 414	155	2.5 ± 0.05	15 ... 17.5	0280150716	white	30
M20B20	1 736 989	155	2.5 ± 0.05	15 ... 17.5	0280150716	white	30
M20B20	1 706 162	170	3.0 ± 0.05	15 ... 17.5	0280150715	blue	30
M20B27	1 706 414	155	2.5 ± 0.05	15 ... 17.5	0280150716	white	30
M20B25	1 706 162	170	3.0 ± 0.05	15 ... 17.5	0280150715	blue	30
M50B20	1 730 059	170	3.0 ± 0.05	15 ... 17.5	0280150414	gray	30
M50B25	1 730 060	180	3.5 ± 0.05	15 ... 17.5	0380150415	green	30

1) With leak rate of 1 drop per minute

* US Version

FUEL SYSTEM

13 - 78

13 64 ... Fuel injectors


	Engine Type	Part Number	Static Flow Rate approx. cm ³ /min.	1) Test Pressure bar	Coil Resistance approx. Ω at 20° C	Code	Plug Color	Approx. Ejection Angle
	M30B30	1 706 176	220	3.0 ± 0.05	15 ... 17.5	0280150714	yellow	30
	M30B30	1 726 983	220	3.0 ± 0.05	15 ... 17.5	0280150714	yellow	30
	M30B30	1 726 988	220	3.0 ± 0.05	15 ... 17.5	0280150714	yellow	30
	M30B35	1 706 176	220	3.0 ± 0.05	15 ... 17.5	0280150714	yellow	30
	M30B35	1 726 983	220	3.0 ± 0.05	15 ... 17.5	0280150714	yellow	30
	M30B35	1 730 292	220	3.0 ± 0.05	15 ... 17.5	73366	yellow	30
	M60B30	1 736 908	240	3.5 ± 0.05		0280150778	red	30
	M60B30	1 747 406	240	3.5 ± 0.05		D 3763 FA	red	
	M60B40	1 736 908	240	3.5 ± 0.05		0280150778	red	30
	M60B40	1 747 406	240	3.5 ± 0.05		D 3763 FA	red	
	S38B35	1 273 272	235	3.0 ± 0.05	2 ... 3	0280150201	gray	30
	S38B36	1 310 641	270	3.0 ± 0.05		0280150701	ivory	30
	S38B38	1 310 641	270	3.0 ± 0.05		0280150701	ivory	30
	S38B38	1 317 446	290	3.0 ± 0.05		D 3764 FA	green	
	M70B50	1 706 162	170	3.0 ± 0.05	15 ... 17.5	0280150715	blue	30
	M70B50	1 731 357	170	3.0 ± 0.05		D 3762 FA	blue	22

1) With leak rate of 1 drop per minute

FUEL SYSTEM	Engine Type	Model	Engine Code on Data Plate	Idling Speed in RPM	Idling Speed with Air Cond. ON in RPM	Shutoff Speed in RPM	Fuel Injection	Since (Month/Year)
13 - 100								
DIESEL								

13 00 ... General Information

	M21 D24	324d	24 6D A	750 ± 50		5150 ± 100	mech.	
	M21 D24	324d	24 6D B	750 ± 50	860 ± 50	5300 ± 100	DDE-2	12/88
	M21 D24	324td	24 6T B	750 ± 50	860 ± 50	5300 ± 100	DDE-1	
	M21 D24	324td	24 6T B	750 ± 50	860 ± 50	5300 ± 100	DDE-1	

FUEL SYSTEM		324d/A	324td/A	624td/A
13 - 101				
DIESEL				
13 31 ... Fuel Supply				
Fuel feed vacuum measured after filter at				
approx. 2000 rpm	mbar	- 40 ... - 60	- 40 ... - 60	
4000 rpm	mbar	- 80	- 80	
	mbar	- 200	- 200	
Pressure with in-tank pump	mbar			200

FUEL SYSTEM			324d/A	324d/A (DDE)	324td/A	524td/A
13 - 102						
DIESEL						
13 51 ... Distributor Injection Pump						
Code			VE 6/10 F 2300 R 206	VE 6/10 E 2400 R 206/1	VE 6/10 E 2400 R 206/1	VE 6/10 E 2400 R 206/1
Internal pump pressure (operating temperature)						
at 750 rpm	bar		≥ 1.5	≥ 4	≥ 4	≥ 4
at 2000 rpm	bar		≥ 4	≥ 5	≥ 5	≥ 5
at 4500 rpm	bar		≥ 7.5	≥ 7	≥ 7	≥ 7
{cold running}						
at 750 rpm	bar		≥	≥	≥	≥
Static injection pump setting (new adjustment)						
Adjustment in TDC position (ignition pos. in cyl. no. 1)	mm		0.74 ± 0.02	1.05 ± 0.02	1.05 ± 0.02	1.05 ± 0.02
Testing value (without new adjustment afterwards)	mm		0.74 ± 0.02	1.05 ± 0.02	1.05 ± 0.02	1.05 ± 0.02

FUEL SYSTEM		334d/A	3241d/A	5241d/A - E 34
13 - 103				
DIESEL				
13 51 ... Electric Shutoff Valve (on Distributor Injection Pump)				
Switching-on voltage	V	at least 10	at least 10	at least 10
Resistance at 20° C	Ω	7.5 ± 1	7.5 ± 1	7.5 ± 1
13 51 ... Electric Cold Start Valve				
Testing voltage	V	12	—	—
Resistance at 20° C	Ω	4.5 ± 1	—	—
13 51 ... Control Box for Absolute Pressure Dependent Injection Ratio				
Regulating pressure of control box (absolute)	mbar	705 ± 15	—	—

FUEL SYSTEM		324d/A	324ed/A	524nd/A - E 34
13 - 104				
DIESEL		since 3/87		
13 53 ... Combination Fuel injector				
Nozzle holder	Code	KCA 30 S 50	KCA 30 S 57¹⁾ KCA 30 S 56	KCA 30 S 57¹⁾ KCA 30 S 56
	Paint dot	white	red	red
Injection nozzle	Code	DNO SD 286	DNO SD 286	DNO SD 286
Opening (injection) pressure				
	Adjusted value			
	bar	130 ... 138	150 ... 158	150 ... 158
Minimum value	bar	120	140	140
Maximum value		140	160	160
Testing oil for injection nozzle tester		Shell Calibration Fluid V 1404	Shell Calibration Fluid V 1404	Shell Calibration Fluid V 1404
Max. deviation in opening pressure among all injection nozzles	bar	10	10	10
Shims				
	Thickness	mm	1.0 ... 2.0	1.0 ... 2.0
Thickness steps	mm	0.05	0.05	0.05
Shim thickness = opening pressure difference	mm/bar	0.1 = 10	0.1 = 10	0.1 = 10

¹⁾ With needle motion sensor

FUEL SYSTEM	334td	324td A	Version	524td	524td A	Version
13 - 105						
DIESEL						

13 51 ... DDE I Control Units

SB (AS) 25 pin connector	Code	0 281 001 063	0 281 001 065	3 T 1/2	0 281 001 078	0 281 001 079	5 T 1	
	BMW No.	2 241 706	2 241 710	3 T 1/2	2 242 212	2 242 214	5 T 1	
ME (MLG) 35 pin connector	Code	0 281 001 064	0 281 001 066	3 T 3	0 281 001 077	0 281 001 080	5 T 3	
	BMW No.	2 244 177	2 244 178	3 T 3	2 242 946	2 242 948	5 T 3	
SB (AS) 25 pin connector	Code	0 281 001 063	0 281 001 065	3 T 3	0 281 001 078	0 281 001 079	5 T 3	
	BMW No.	2 241 706	2 241 710	3 T 3	2 242 947	2 242 049	5 T 3	
ME (MLG) 35 pin connector	Code	0 281 001 089	0 281 001 091	3 T 4	0 281 001 077	0 281 001 080	5 T 4	
	since 5/88	BMW No.	2 242 963	2 242 965	3 T 4	2 242 967	2 242 969	5 T 4
	since 10/88	BMW No.	2 243 212	2 243 213	3 T 4	2 243 184 *	2 243 211 *	5 T 4
SB (AS) 25 pin connector	Code	0 281 001 088	0 281 001 090	3 T 4	0 281 001 078	0 281 001 079	5 T 4	
	since 5/88	BMW No.	2 242 964	2 242 966	3 T 4	2 242 968	2 242 970	5 T 4
ME (MLG) 35 pin connector	Code	0 281 001 089	0 281 001 091	3 T 5	0 281 001 077	0 281 001 080	5 T 5	
	since 12/88	BMW No.	2 243 113	2 243 115	3 T 5	2 243 117	2 243 119	5 T 5
SB (AS) 25 pin connector	Code	0 281 001 088	0 281 001 090	3 T 5	0 281 001 078	0 281 001 079	5 T 5	
	since 12/88	BMW No.	2 243 114	2 243 116	3 T 5	2 243 118	2 243 120	5 T 5

* Only for replacement

FUEL SYSTEM		324td	324td A	Version	524td	524td A	Version
13 - 105							
DIESEL							
13 61 . . Control Units							
ME (MLG) 35 pin connector	Code	0 281 001 089	0 281 001 092	3 T 6	0 281 001 077	0 281 001 080	5 T 6
	BMW No.	2 243 618	2 243 620	3 T 6	2 243 622	2 243 624	5 T 6
SB (AS) 25 pin connector	Code	0 281 001 088	0 281 001 088	3 T 6	0 281 001 078	0 281 001 078	5 T 6
	BMW No.	2 243 619	2 243 619	3 T 6	2 243 623	2 243 623	5 T 6
ME (MLG) 35 pin connector since 7/99	Code	0 281 001 089	0 281 001 092	3 T 7	0 281 001 077	0 281 001 080	5 T 7
	BMW No.	2 244 124	2 244 125	3 T 7	2 244 126	2 244 127	5 T 7
Diesel Engine Vehicles with Catalytic Converter							
ME (MLG) 35 pin connector	Code	0 281 001 089	0 281 001 091	3 T 6	0 281 001 077	0 281 001 080	5 T 6
	BMW No.	2 243 618	2 243 620	3 T 6	2 243 622	2 243 624	5 T 6
SB (AS) 25 pin connector	Code	0 281 001 123	0 281 001 123	3 C 6	0 281 001 122	0 281 001 122	5 C 6
	BMW No.	2 243 915	2 243 915	3 C 6	2 243 916	2 243 916	5 C 6
ME (MLG) 35 pin connector	Code	0 281 001 089	0 281 001 091	3 T 7	0 281 001 077	0 281 001 080	5 T 7
	BMW No.	2 244 124	2 244 125	3 T 7	2 244 126	2 244 127	5 T 7

FUEL SYSTEM	324d	324d A	Version
13 - 197			
DIESEL			

13 51 ... Control Units			
DDE 2 55 pin connector	Code	0 261 001 082	0 261 001 083
	BMW No.	2 243 028	2 243 029
DDE 2 55 pin connector	Code	0 261 001 082	0 261 001 083
	BMW No.	2 243 292	2 243 293
since 5/89			

FUEL SYSTEM	ME 3T3	ME 3T4	ME 3T5 ME 3T6 ME 3T7	ME 5T3	ME 5T4	ME 5T5 ME 5T6 ME 5T7
13 - 100						
DIESEL						
Permitted Combination of DDE-1 Control Units						
	SB 3T1			SB 5T1	SB 5T1	SB 5T1
	SB 3T2					
	SB 3T3			SB 5T3	SB 5T3	SB 5T3
		SB 3T4	SB 3T4	SB 5T4	SB 5T4	SB 5T4
		SB 3T5	SB 3T5	SB 5T5	SB 5T5	SB 5T5
		SB 3T6	SB 3T6	SB 5T6	SB 5T6	SB 5T6
		SB 3T7	SB 3T7	SB 5T7	SB 5T7	SB 5T7

Also refer to Service Information
of Group 13.

Important!
Basically a control unit may only
be replaced by one of the same or
better version.

FUEL SYSTEM	324td	324td A	524td - E 34	524td A - E 34
13 - 109				
DIESEL				
13 62 ... Charge Pressure Sensor				
	Code	0 281 002 0218		
	BMW No.	13 62 2 241 500		
Power supply	V	5 ± 0.25		

FUEL TANK AND LINES		316H 318Hs 324d 324dS	320H 325H 320Hs	M 3 M 3 C
16 - 300				
16 11 ... Fuel Tank				
Tank volume / reserve	ltr.	55 / 5	60 / 5	55 / 5
With additional tank	ltr.		70 / 5	70 / 5
Venting: discharged outdoors via expansion tank. With catalytic converter via carbon canister into intake system				
16 14 ... Electric Fuel Pump				
Code		05 80 464 032	644 29 20	05 80 464 032
Operating pressure	bar	3	3	3
Delivery rate at 12 V (pump removed, tested with testing fluid, approx. 20° C, 3 bar counterpressure)	ltr./min.	1.9	2.1	1.9
Delivery rate (tested with installed pump and counterpressure – see Repair Manual Gr. 13)	cm ³ /30 sec.	675	675	675
Typical power consumption	A	5	7	5

FUEL TANK AND LINES		3 Series E 30	3 Series E 30	3 Series E 30
16 - 301		a) 316 b) 318 c) 324d d) 324td	320i 325i	M 3
16 14 . . Fuel Level Sensor				
* Plastic version ** Addition tank				
Code		a/b) 817/036/001* a/b) 817 1013 1010 c/d) 817/031/002	right 817/022/007 left 802/033/001	802/029/001** 817/1010 1010 817/036/005*
Resistance at conn. G				
With empty tank	Ω	58.8 ± 1.9	right 58.8 ± 1.9 left 66.1 ± 2.1	58.8 ± 1.9
With full tank	Ω	32. ± 0.7	right 3.2 ± 0.7 left	3.2 ± 0.7
16 14 . . Fuel Intake with Transfer Pump				
Current consumption at 13 V	A	1.4	1.4	1.4
Delivery pressure at + 20° C	bar	0.2	0.2	0.2

RADIATOR		E 30	E 30	E 30	E 30	E 30	E 30	M3
17 - 1		M10	M40B16 M40B18	M42B18	M20B20	M20B25	M21D24	S14
17 10 ... Cooling System in General								
Coolant volume (incl. heater)	ltr.	7	7	6.4	10.5	10.5	12	9
With integrated air conditioner	ltr.				11.0	11.0		
Coolant specifications		See Operating Fluids						
Testing pressure for cooling system	bar	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17 11 ... Cooling System Cap								
Pressure valve opens at	bar	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.1	1.0 ± 0.1	1.5 ± 0.1
Vacuum valve opens at (absolute)	bar	0.9	0.9	0.9	0.9	0.9	0.9	0.9
17 11 ... Radiator								
Testing pressure	bar	1.5	1.5	1.5	1.5	1.5	1.5	1.5

CLUTCH**All Models****21 - 1****21 21 ... Clutch****Lateral runout deviation of diaphragm springs to pressure plate****mm****0.5****Drive plate****Minimum thickness****mm****7.5****Permitted lateral runout****mm****0.5**

MANUAL TRANSMISSION	3 Series E 30 / E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
23 - 1					
Transmission Survey					
Getrag 240/S Overdrive	316 ... 318ls 320i ... 324d	518i, 520i			
ZF-5S-16/S Overdrive	M 10: 316 ... 318i 320i	520i			
Getrag 260/S Overdrive		524id ... 525i M 50: 520i, 525i			
Getrag 260/S Sport	325i				
Getrag 260/S Overdrive		530i ... 535i	635CSI	730i ... 735i	
Getrag 265/S Sport	320is, M 3				
Getrag 280/S Sport		M 5	M 63s/CSI		
Getrag G3-6 S 560/4.25 G (286/S)					850i
S 5 D 200 G	E 36: 316i, 318i	520i			
S 5 D 310 Z	E 36: 325i	525i			
S 5 D 320 G	325i				

MANUAL TRANSMISSION		240/5 Overdrive	2F-55-16 Overdrive	260/5 Overdrive	260/5 Overdrive 5241d	260/5 Sport
23 - 2						
23-00 ... Transmission in General						
Oil grade		see Operating Fluids	see Operating Fluids	see Operating Fluids	see Operating Fluids	see Operating Fluids
Oil volume	ltr.	1.05 (1.15*)	1.05 (1.15*)	1.25 (1.35*)	1.25 (1.35*)	1.25 (1.35*)
1st gear	Number of teeth	33 x 41/26 x 14	35 x 43/27 x 15	34 x 41/26 x 14	35 x 43/26 x 13	32 x 41/28 x 14
	Ratio	3.72	3.73	3.83	4.35	3.35
2nd gear	Number of teeth	33 x 35/26 x 22	35 x 33/27 x 21	34 x 37/26 x 22	35 x 39/26 x 22	32 x 39/28 x 22
	Ratio	2.62	2.64	2.20	2.33	2.63
3rd gear	Number of teeth	33 x 28/26 x 27	35 x 31/27 x 30	34 x 30/26 x 28	35 x 30/26 x 29	32 x 31/28 x 26
	Ratio	1.32	1.34	1.40	1.39	1.36
4th gear	Number of teeth	—	—	—	—	—
	Ratio	—	—	1.0	1.0	1.0
5th gear	Number of teeth	33 x 26/26 x 41	35 x 24/27 x 38	34 x 26/26 x 42	35 x 26/26 x 43	32 x 27/28 x 38
	Ratio	0.81	0.80	0.81	0.81	0.81

* For initial filling or exchange transmission

MANUAL TRANSMISSION	240iS Overdrive	27-33-18 Overdrive	260iS Overdrive	260iS Overdrive 324td	260iS Sport
23 - 3					

23 00 ... Transmission in General

Reverse gear	Number of teeth	<u>33 x 24 x 38</u> 28 x 14 x 24	<u>35 x 41</u> 27 x 15	<u>34 x 21 x 37</u> 28 x 14 x 21	<u>35 x 22 x 36</u> 28 x 13 x 22	<u>32 x 21 x 37</u> 28 x 14 x 21
	Ratio	3.45	3.54	3.45	3.73	3.02

23 11 ... Case and Covers

Temperature for installation of bearings	° C	80
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23 21 ... Transmission Shafts

<div> <div> Axial play (axial bearing clearance) of:</div> <div>Output shaft</div> </div>	mm	0 ... 0.09				
Input shaft	mm	0 ... 0.09	1.1 ... 1.3	0 ... 0.09	0 ... 0.09	0 ... 0.09
Layshaft	mm	0.1 ... 0.2	—	0.1 ... 0.2	0.1 ... 0.2	0.13 ... 0.23
<div> <div>Output journal on output shaft</div> <div>Radial runout</div> </div>	mm	0.07				
<div> <div>Output flange</div> <div>Radial runout</div> </div>	mm	0.07				
<div> <div> Axial runout</div> </div>	mm	0.1				

MANUAL TRANSMISSION		240/5 Overdrive	ZF-35-16 Overdrive	260/5 Overdrive	280/5 Sport
23 - 4					
23 22 ... Gears (Layshaft)					
Pressing-off force at ambient temp. 3rd gear	tons	—	approx. 7.5	—	—
	4th gear	tons	approx. 8.0	—	—
	5th gear	tons	4.5 ... 5.5	approx. 8.0	5.5 ... 6.8
Pressing-on force at temp. 3rd gear	tons ° C	— —	— —	— —	— —
	4th gear	tons ° C	0.015 150 ... 180	— —	— —
	5th gear	tons ° C	4.5 ... 5.5 approx. 120	— —	4.9 ... 6.8 approx. 120
23 23 ... Guide Sleeves					
Pressing-off force (max.) 1st/2nd and 5th/reverse gears	tons	3.0	—	3.7	3.7
	3rd/4th gears	tons	2.7	3.0	3.0
Pressing-on force (max.) 1st/2nd and 5th/reverse gears	tons	2.1	0.08	2.5	2.5
	3rd/4th gears	tons	1.9	2.1	2.1
Bearing sleeve temp.	° C	approx. 80	approx. 80	approx. 80	approx. 80

MANUAL TRANSMISSION		240/5 Overdrive	2F-55-16 Overdrive	260/5 Overdrive	260/5 Sport
23 - 5					
23 23 ... Synchronization					
Distance between synchromesh ring and clutch body					
New condition	mm	1.0 ... 1.3			
Max. wear limit size	mm	0.8			
Reverse gear					
New condition	mm	0.5 .. 0.6			
Max. wear limit size	mm	0.4			
23 31 ... Internal Shift Components					
Shift fork guide width					
1st ... 5th gears					
Wear limit	mm	4.8			

MANUAL TRANSMISSION		260/5 Overdrive	265/5 Sport	265/6 Overdrive	280/5 Sport
23 - 7					
23 00 ... Transmission In General					
Reverse gear	Number of teeth	$\frac{34 \times 21 \times 37}{26 \times 14 \times 21}$	$\frac{38 \times 16 \times 41}{23 \times 16 \times 16}$	$\frac{34 \times 19 \times 34}{26 \times 12 \times 19}$	$\frac{34 \times 19 \times 24}{26 \times 12 \times 19}$
	Ratio	3.46	4.23	3.76	3.71
23 11 ... Case and Covers					
Temperature for installation of bearings	° C	80	80	80	80
23 21 ... Transmission Shafts					
Axial play (axial bearing clearance) of:	mm	0 ... 0.09	0 ... 0.09	0 ... 0.09	0 ... 0.09
Output shaft	mm	0 ... 0.09	0 ... 0.09	0 ... 0.09	0 ... 0.09
Input shaft	mm	0 ... 0.09	0 ... 0.09	0 ... 0.09	0 ... 0.09
Layshaft	mm	0.1 ... 0.2	0.1 ... 0.2	0.1 ... 0.2	
Output journal on output shaft Radial runout	mm	0.07	0.07	0.07	0.07
Output flange Radial runout	mm	0.07	0.07	0.07	0.07
Axial runout	mm	0.1	0.1	0.1	0.1

MANUAL TRANSMISSION		260/6 Overdrive	265/5 Sport	265/6 Overdrive	260/5 Sport
23 - 8					
23 22 . . . Gears (Layshaft)					
Pressing-off force at ambient temp. 3rd gear	tons	—	5 ... 7	5 ... 7	5 ... 7
4th gear	tons	—	5 ... 7	5 ... 7	5 ... 7
5th gear	tons	5.5 ... 6.8	9 ... 10	9 ... 10	9 ... 10
Pressing-on force at temp. 3rd gear	tons ° C	— —	— —	— —	— —
4th gear	tons ° C	— —	— —	— —	— —
5th gear	tons ° C	4.9 ... 6.8 approx. 120	5 ... 6 approx. 150	5 ... 6 approx. 150	5 ... 6 approx. 150
23 23 . . . Guide Sleeves					
Pressing-off force (max.) 1st/2nd and 5th/reverse gears	tons	3.7	—	—	—
3rd/4th gears	tons	3.0	—	—	—
Pressing-on force (max.) 1st/2nd and 5th/reverse gears	tons	2.5	—	—	—
3rd/4th gears	tons	2.1	—	—	—
Bearing sleeve temp.	° C	approx. 80	approx. 80	approx. 80	approx. 80

MANUAL TRANSMISSION		260/6 Overdrive	265/5 Sport	265/6 Overdrive	280/5 Sport
23 - 9					
23 23 Synchronization					
Distance between synchromesh ring and clutch body					
New condition	mm	1.0 ... 1.3			
Max. wear limit size	mm	0.8			
Reverse gear					
New condition	mm	0.5 ... 0.6			
Max. wear limit size	mm	0.4			
23 31 . . Internal Shift Components					
Shift fork guide width					
1st ... 5th gears					
Wear limit	mm	4.8			

MANUAL TRANSMISSION		S 5 D 200 G / 250 G	S 5 D 310 Z	S 6 S 560 G
23 - 10				
23 00 ... Transmission in General				
Oil grade			see Operating Fluids	
Oil volume ltr.		1.0 (1.1")	1.2 (1.3")	2.3 (2.5")
1st gear	Number of teeth	40 x 46 / 29 x 15	43 x 41 / 30 x 14	42 x 47 / 29 x 16
	Ratio	4.23	4.20	4.25
2nd gear	Number of teeth	40 x 42 / 29 x 23	43 x 40 / 30 x 23	42 x 42 / 29 x 24
	Ratio	2.52	2.49	2.53
3rd gear	Number of teeth	40 x 43 / 29 x 29	43 x 36 / 30 x 31	42 x 36 / 29 x 31
	Ratio	1.67	1.67	1.68
4th gear	Number of teeth	40 x 41 / 29 x 35	43 x 32 / 30 x 37	42 x 29 / 29 x 34
	Ratio	1.22	1.24	1.23
5th gear	Number of teeth	—	—	—
	Ratio	1.0	1.0	1.0

MANUAL TRANSMISSION		S 5 D 200 G / 250 G	S 5 D 310 Z	S 5 S 560 G
23 - 11				
23 00 ... Transmission in General				
4th gear	Number of teeth	—	—	42 x 31 / 29 x 54
	Ratio	—	—	0.83
Reverse gear	Number of teeth	40 x 23 x 41 / 29 x 14 x 25	45 x 23 x 38 / 30 x 14 x 23	42 x 23 x 43 / 29 x 16 x 23
	Ratio	4.04	3.89	3.89
23 11 ... Case and Cover				
Temperature for bearing installation	°C	approx. 80	approx. 80	approx. 80
23 21 ... Transmission Shafts				
Max. axial play (axial bearing clearance) of Output shaft	mm	0 ... 0.09	0 ... 0.09	0 ... 0.09
	mm	0.04	—	—
Input shaft	mm			
Layshaft	mm			
Max. radial runout of output journal on output shaft	mm	0.07	0.07	0.07
Output flange Max. radial runout	mm	0.07	0.07	0.07
	mm	0.1	0.1	0.1

MANUAL TRANSMISSION			S 5 D 200 G / 250 G	S 5 D 310 Z	S 6 S 560 G
23 - 12					
23 22 ... Gears (Layshaft)					
Pressing off and on force 5th gear	KN		50 ... 70		
23 23 ... Guide Sleeves					
Pressing off and on force	KN		10 ... 20		
23 23 ... Synchronesh Ring					
Distance between synchronesh ring and clutch body New condition					
1st/2nd gear	mm		1.3 ... 2.1	1.1 ... 1.6	
	mm		1.1 ... 1.5	0.95 ... 1.35	
	mm		0.9 ... 1.5	0.95 ... 1.35	
4th/5th gear	mm				
Max. wear distance	mm		0.8	0.8	0.8
Reverse gear New condition					
	mm		1.1 ... 1.7	0.7 ... 1.15	
Max. wear distance	mm		0.5	0.5	0.5

Automatic Transmission		316 A 316 1A 318 1A 320 1A
24 - 391		
24 00	Transmission in General	
Designation		ZF - 4 HP - 22H
Code letter on data plate		see Parts Catalog
Ratio	1st gear	2.48
	2nd gear	1.48
	3rd gear	1.0
	4th gear	0.73
	reverse	2.69
Oil grade		see Operating Fluids
Total oil filling volume (transmission and torque converter empty)		
	ltr. (USimp. pts.)	6.4 (13.53/11.25)
Oil change volume (transmission at operating temperature)		
	ltr. (USimp. pts.)	3.9 (8.34/5.28)

AUTOMATIC TRANSMISSION ZF-4HP-22H		316 A	316 IA	316 IA**	316 IA 318 IA K	320 IA	320 IA K
24 – 302							
3 Series - E 30							
24 00 ... Shift Points							
Selector lever in D	1-2	2100 ... 2200	2400 ... 2500	2400 ... 2500	2200 ... 2300	2400 ... 2500	2400 ... 2500
Accel. pedal at partial throttle	2-3	2200 ... 2500	2500 ... 2600	2500 ... 2700	2300 ... 2500	2400 ... 2500	2400 ... 2600
Shift point at engine speed (rpm)	3-4	2200 ... 2300	2500 ... 2600	2500 ... 2600	2300 ... 2500	2400 ... 2500	2400 ... 2500
	CL closed	2600 ... 2700	2800 ... 2900	2900 ... 3000	2600 ... 2800	2700 ... 2800	2700 ... 2800
	CL opened	2100 ... 2200	2100 ... 2200	2200 ... 2400	2100 ... 2200	2100 ... 2200	2100 ... 2200
Shift point at road speed (km/h)	1-2	16 ... 17	15 ... 16	14 ... 15	15 ... 16	14 ... 15	14 ... 15
	2-3	31 ... 39	24 ... 33	27 ... 34	29 ... 37	23 ... 32	25 ... 33
	3-4	45 ... 52	40 ... 47	40 ... 45	43 ... 49	38 ... 45	38 ... 45
	CL closed	84 ... 90	84 ... 90	79 ... 83	86 ... 90	81 ... 86	78 ... 83
	CL opened	82 ... 87	82 ... 87	77 ... 81	83 ... 88	79 ... 84	75 ... 80
Selector lever in D	1-2	4200 ... 4900	3800 ... 4500	4700 ... 5400	4600 ... 5300	3900 ... 4600	4700 ... 5400
Accel. pedal at full throttle	2-3	5000 ... 5400	4700 ... 5200	5000 ... 5500	5000 ... 5400	4800 ... 5300	5000 ... 5500
Shift point at engine speed (rpm)	3-4	4500 ... 5000	4400 ... 4800	4700 ... 5000	4600 ... 5000	4500 ... 4800	4700 ... 5000
	*4-3	2600 ... 2900	2500 ... 2700	2600 ... 2900	2600 ... 2900	2500 ... 2700	2500 ... 2800
	3-2	2600 ... 3100	2900 ... 3100	2900 ... 3200	3000 ... 3200	2800 ... 3100	2900 ... 3100
	2-1	2400 ... 2700	2600 ... 2800	2700 ... 3100	2800 ... 3100	2600 ... 2700	2700 ... 3100
Shift point at road speed (km/h)	1-2	45 ... 54	40 ... 49	44 ... 51	47 ... 56	38 ... 47	41 ... 54
	2-3	91 ... 100	88 ... 95	80 ... 88	87 ... 96	83 ... 91	83 ... 91
	3-4	124 ... 135	118 ... 128	109 ... 118	119 ... 129	114 ... 123	113 ... 123
	*4-3	102 ... 112	98 ... 106	89 ... 98	97 ... 107	92 ... 102	92 ... 102
	3-2	67 ... 76	62 ... 72	58 ... 67	64 ... 73	59 ... 68	59 ... 68
	2-1	32 ... 44	25 ... 39	32 ... 43	35 ... 47	23 ... 37	33 ... 45

* CL closed prior to shift

** 1000 Module

AUTOMATIC TRANSMISSION ZF-6HP-32/H		316 A	316 IA	316 IA**	318 IA 318 IA K	320 IA	320 IA K
24 ... 303							
3 Series - E 30							
24 00 . Shift Points							
Selector lever in D	1-2	5300 ... 5900	4900 ... 5500	5400 ... 6000	5300 ... 6000	4900 ... 5600	5400 ... 6100
Accel. pedal at kickdown	2-3	5500 ... 5900	5200 ... 5600	5500 ... 5900	5500 ... 5900	5300 ... 5700	5500 ... 6000
Shift point at engine speed (rpm)	3-4	—	—	5800 ... 6100	5900 ... 6100	—	6180 ... 6250
	4-3	Immediately	Immediately	4100 ... 4200*	4100 ... 4200*	Immediately	4300 ... 4350*
	3-2	3700 ... 4000	3600 ... 3800	3800 ... 4000	3700 ... 4000	3800 ... 3900	3500 ... 3900
	2-1	3000 ... 3400	2900 ... 3300	3000 ... 3500	3000 ... 3400	2900 ... 3400	3000 ... 3300
Shift point at road speed (km/h)	1-2	58 ... 66	53 ... 61	51 ... 58	55 ... 63	51 ... 58	51 ... 59
	2-3	101 ... 110	96 ... 104	89 ... 96	95 ... 105	92 ... 100	92 ... 100
	3-4	—	—	143 ... 147	155 ... 159	—	162 ... 164
	4-3	Immediately	Immediately	140 ... 144*	151 ... 156*	Immediately	157 ... 159*
	3-2	96 ... 105	90 ... 100	84 ... 92	91 ... 100	86 ... 95	86 ... 95
	2-1	48 ... 58	43 ... 53	41 ... 51	45 ... 55	41 ... 51	41 ... 51
Manual shift at engine speed (rpm)	4-3	Immediately	Immediately	Immediately	Immediately	Immediately	Immediately
	3-2	3300 ... 3700	3100 ... 3500	3300 ... 3700	3300 ... 3700	3100 ... 3500	3100 ... 3500
	2-1	2500 ... 3100	2200 ... 2800	2500 ... 3100	2500 ... 3100	2300 ... 3000	2300 ... 3000
Manual shift at road speed (km/h)	4-3	Immediately	Immediately	Immediately	Immediately	Immediately	Immediately
	3-2	97 ... 108	92 ... 103	85 ... 95	93 ... 103	88 ... 99	88 ... 99
	2-1	52 ... 61	47 ... 57	45 ... 54	48 ... 58	45 ... 54	45 ... 54
Reverse gear interlock at road speed (km/h)		20 ... 22	19 ... 21	18 ... 19	19 ... 21	18 ... 20	18 ... 20

* CL closed prior to shift

** 1993 models

AUTOMATIC TRANSMISSION ZF – 4 HP – 22/H		316 A 316 iA	318 iA 318 iA K	320 iA	320 iA K	
24 – 304						
24 00 Oil Pressure						
Pump pressure with selector lever in D						
1st gear						
Idle	bar (psi)	8.0 ... 7.5 (86 ... 107)				
Kickdown	bar (psi)	9.1 ... 10.1 (130 ... 144)	9.6 ... 10.6 (137 ... 151)			
Engine speed	rpm	approx. 4,000				
2nd ... 4th gears						
Idle	bar (psi)	4.8 ... 5.8 (66 ... 82)				
Kickdown	bar (psi)	7.2 ... 8.0 (103 ... 114)	7.6 ... 8.6 (108 ... 121)			
Reverse gear						
Idle	bar (psi)	11.0 ... 13.0 (157 ... 185)				
Kickdown	bar (psi)	14.8 ... 16.7 (211 ... 237)	15.7 ... 17.6 (224 ... 250)			
Converter pressure with selector lever in D – CL closed –		max. 0.7 (10)				
24 21 ... Input Shaft						
Axial play of input shaft		0.2 ... 0.4 (0.008 ... 0.016)				
24 30 ... Valve Body						
Distance adjusted between valve body and needle on throttle piston		11.5 (0.453)				

AUTOMATIC TRANSMISSION
ZF-4 HP-22/H

24 - 305

316 A

316 iA

318 iA
318 iAK

320 iA

320 iAK

24 40 . Torque Converter

Converter diameter	mm (in.)	230 (9.055)				
Code		V 2	U 4	R 5	V 2	
Start speed	rpm	2100 . 2300	2100 .. 2300	2100 . 2300	2150 . 2400	
Journal diameter	mm (in.)	32 (1.260)				

Automatic Transmission		325 1A 325 1XA	324 dA 324 iDA
24 - 306			
24 00 , Transmission in General			
Designation		ZF - 4 HP - 22/H	
Code letters on data plate		see Parts Catalog	
Ratios	1st gear	2.48	2.73
	2nd gear	1.48	1.56
	3rd gear	1.00	1.00
	4th gear	0.73	0.73
	reverse	2.09	2.09
Oil grade		see Operating Fluids	
Total oil filling volume (transmission and torque converter empty) ltr. (US/imp. pts.)		7.5 (15.85/13.20)	
Oil change volume (transmission at operating temperature) ltr. (US/imp. pts.)		3.0 (6.34/5.28)	

AUTOMATIC TRANSMISSION ZF-4HP-22/H		325 IA	325 IAK	325 IXA	325 IXAK	324 dA	324 dA
24 - 307							
3 Series - II 30							
24 00 - Shift Points							
Selector lever in D	1-2	2300 ... 2400		2300 ... 2400		2100 ... 2200	2700 ... 2800
Accel. pedal at partial throttle	2-3	2400 ... 2600		2400 ... 2600		2100 ... 2200	2700 ... 2800
Shift point at engine speed (rpm)	3-4	2400 ... 2460		2400 ... 2500		2100 ... 2200	2700 ... 2800
	CL closed	2500 ... 2600		2500 ... 2600		2300 ... 2300	2700 ... 2800
	CL opened	1900 ... 2000		1900 ... 2000		1800 ... 2000	1580 ... 1600
Shift point at road speed (km/h)	1-2	17 ... 18		16 ... 17		20 ... 21	21 ... 22
	2-3	33 ... 41		31 ... 39		32 ... 33	32 ... 34
	3-4	48 ... 55		46 ... 52		47 ... 53	50 ... 55
	CL closed	60 ... 63		76 ... 82		64 ... 90	77 ... 79
	CL opened	77 ... 83		74 ... 78		61 ... 67	72 ... 76
Selector lever in D	1-2	4200 ... 4900		4200 ... 4900		3300 ... 3900	3400 ... 3900
Accel. pedal at full throttle	2-3	5000 ... 5400		5000 ... 5400		4000 ... 4400	3900 ... 4300
Shift point at engine speed (rpm)	3-4	4600 ... 5000		4600 ... 5000		3800 ... 4100	3700 ... 3900
	*4-3	2600 ... 2900		2600 ... 2900		2200 ... 2400	2000 ... 2200
	3-2	2800 ... 3000		2900 ... 3100		2400 ... 2500	2700 ... 2800
	2-1	2400 ... 2800		2500 ... 2800		2300 ... 2400	2700 ... 2800
Shift point at road speed (km/h)	1-2	48 ... 57		46 ... 54		36 ... 43	38 ... 45
	2-3	97 ... 106		92 ... 101		80 ... 88	80 ... 89
	3-4	131 ... 142		125 ... 136		115 ... 125	115 ... 124
	*4-3	107 ... 118		102 ... 113		95 ... 104	95 ... 104
	3-2	70 ... 80		67 ... 77		55 ... 65	58 ... 66
	2-1	31 ... 44		31 ... 44		32 ... 33	32 ... 36

* CL closed prior to shift

AUTOMATIC TRANSMISSION ZF-4HP-22iH		325 1A	325 1A K	325 1XA	325 1XA K	324 dA	324 IdA
24 – 308							
3 Series - E 30							
24 00 ... Shift Points							
Selector lever in D	1-2	5300 ... 6000	5300 ... 6000			4200 ... 4900	4200 ... 4900
Accel. pedal at kickdown	2-3	5500 ... 5900	5500 ... 5900			4500 ... 4900	4300 ... 4600
Shift point at engine speed (rpm)	3-4	6100 ... 6200	6000 ... 6100			–	–
	*4-3	4200 ... 4300	4100 ... 4200			immediately	immediately
	3-2	3700 ... 4000	3700 ... 4000			2900 ... 3100	3000 ... 3200
	2-1	2900 ... 3300	2900 ... 3300			2400 ... 2700	2600 ... 3000
Shift point at road speed (km/h)	1-2	61 ... 70	61 ... 70	59 ... 65		47 ... 56	50 ... 57
	2-3	107 ... 116	107 ... 116	102 ... 111		89 ... 97	89 ... 97
	3-4	175 ... 177	175 ... 177	166 ... 168		–	–
	*4-3	168 ... 171	168 ... 171	161 ... 163		immediately	immediately
	3-2	101 ... 111	101 ... 111	96 ... 105		83 ... 92	84 ... 92
	2-1	50 ... 61	50 ... 61	43 ... 58		37 ... 47	40 ... 50
Manual shift at engine speed (rpm)	4-3	immediately	immediately			immediately	immediately
	3-2	3300 ... 3700	3300 ... 3700			2700 ... 3000	2300 ... 2600
	2-1	2500 ... 3000	2500 ... 3000			2100 ... 2600	2100 ... 2500
Manual shift at road speed (km/h)	4-3	immediately	immediately	immediately		immediately	immediately
	3-2	103 ... 114	103 ... 114	98 ... 109		93 ... 104	85 ... 96
	2-1	55 ... 65	55 ... 65	52 ... 62		48 ... 58	51 ... 60
Reverse gear interlock at road speed (km/h)		21 ... 23	21 ... 23	20 ... 22		26 ... 28	28 ... 30

* Cl. closed prior to shift

AUTOMATIC TRANSMISSION ZF 4 HP – 22/H	325 iA	325 iA K	325 iXA	325 iXA K	324 dA	324 i dA
24 – 309						

24 00 Oil Pressure

Pump pressure with selector lever in D		
1st gear		
Idle	bar (psi)	6.0 – 7.5 (86 – 106)
Kickdown	bar (psi)	9.0 – 11.0 (128 – 156)
Engine speed	rpm	approx. 4,000
2nd – 4th gears		
Idle	bar (psi)	4.6 – 6.0 (66 – 85)
Kickdown	bar (psi)	7.0 – 9.0 (100 – 128)
Reverse gear		
Idle	bar (psi)	11.0 – 14.0 (157 – 199)
Kickdown	bar (psi)	17.0 – 20.0 (242 – 284)
Converter pressure with selector lever in D – CL closed –		
	bar (psi)	maximum 0.7 (10)

24 21 Input Shaft

Axial play of input shaft	mm (in.)	0.2 – 0.4 (0.008 – 0.016)
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24 30 Valve Body

Distance adjusted between valve body and needle on throttle piston	mm (in.)	11.5 (0.453)
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AUTOMATIC TRANSMISSION ZF-4HP-22H		325 1A	325 1A K	325 1XA	325 1XA K	324 dA	324 1dA
24 – 310							
3 Series - E 30							
24 31 Primary Pump							
Radial play	mm (In.)	0.09 0.14 (0.0035 ... 0.0055)					
Axial play	mm (In.)	0.03 0.06 (0.0012 0.0024)					
24 40 Torque Converter							
Converter diameter	mm (In.)	260 (10.236)					
Code		W 2				A 5	P 7
Stall speed	rpm	2100 ... 2300	2200 ... 2400	2100 ... 2300	2100 2300	2150 2350	2150 ... 2350
Journal diameter	mm (In.)	32 (1.260)					
24 61 Downshift Preventing Control Unit							
Bosch No.		0260 002 020		0260 002 032			

Automatic Transmission	320 IAK	325 IA	325 IAK	325 IKA	325 IKAk
24 - 311					

24 00 - Transmission in General				
Designation		ZF - 4 HP - 22-EM		
Code on data plate		see Parts Catalog		
Ratios	1st gear	2.48		
	2nd gear	1.48		
	3rd gear	1.00		
	4th gear	0.73		
	reverse	2.09		
Oil grade		see Operating Fluids		
Total oil filling volume (transmission and torque converter empty)		ltr. (US/imp. pts.)	7.5 (15.85 / 13.20)	
Oil change volume (transmission at operating temperature)	ltr. (US/imp. pts.)	320 IAK: 6.4 (13.53/11.28)		
		3.0 (6.34 / 5.28)		

AUTOMATIC TRANSMISSION ZF - 4 HP - Z2/EH	320 iA K	325 iA	325 iA K	325 iXA	325 iXA K	
24 - 312						

24 00 - Shift Points

Program E	1-2	2000 - 2300	2000 - 2200	
Selector lever in D	2-3	2300 - 2500	2000 - 2200	
Accel. pedal in partial throttle	3-4	2700 - 2900	2100 - 2250	
Shift at engine speed (rpm)	CL closed	2600 - 2700	2300 - 2400	
	CL opened	2100 - 2300	1880 - 2000	
Shift at road speed (km/h)	1-2	13 - 18	17 - 22	
	2-3	32 - 38	30 - 37	
	3-4	68 - 73	53 - 59	
	CL closed	89 - 94	83 - 89	
	CL opened	80 - 86	77 - 84	
Selector lever in D	1-2	4800 - 5300	4100 - 4600	
Accel. pedal in full throttle	2-3	4500 - 4800	4300 - 4800	
Shift at engine speed (rpm)	3-4**	4800 - 5000	4600 - 4800	
	4-3**	2900 - 3100	2800 - 3000	
	3-2	2900 - 3000	2700 - 2900	
	2-1	2600 - 2700	2400 - 2500	
Road speed shift (km/h)	1-2	45 - 51	47 - 53	
	2-3	74 - 79	63 - 69	
	3-4**	131 - 137	138 - 144	
	4-3**	109 - 114	116 - 122	
	3-2	62 - 68	66 - 72	
	2-1	31 - 37	31 - 37	

* CL closed prior to shift

AUTOMATIC TRANSMISSION ZF – 4 HP – 22/EH	320 iA K	325 iA	325 iA K	325 iXA	325 iXA K	
24 – 313						

24 00 Shift Points

Program E						
Selector lever in D	1–2	5500	6000	5400	5900	
Accel. pedal in lockdown	2–3	5700	6000	5800	5900	
Engine speed shift (rpm)	3–4**	6000	6200	6100	6300	
	4–3**	4300	4400	4300	4500	
	3–2	3600	3800	3500	3700	
	2–1	3000	3200	2900	3100	
Road speed shift (km/h)	1–2	52 ... 58		63	69	
	2–3	95 ... 100		110	118	
	3–4**	164 ... 170		183	189	
	4–3**	160 ... 165		177 ... 183		
	3–2	87 ... 92		96	102	
	2–1	43 ... 49		51 ... 57		
Manual shift at engine speed (rpm)	4–3**	4300	4400	4300	4500	
	3–2	3100	3300	3000	3200	
	2–1	2400	2700	2300	2600	
at road speed (km/h)	4–3**	160 ... 168		178	184	
	3–2	89 ... 94		94 ... 100		
	2–1	45 ... 50		50 ... 57		
Reverse gear interlock at road speed	km/h	4.6 ... 10.0		5.0 ... 11.0		

** CL closed prior to shift

AUTOMATIC TRANSMISSION ZF – 4 HP – 22/EH		320 iA K	325 iA	325 iA K	325 iXA	325 iXA K	
24 – 314							
24 00 Oil Pressure							
Pump pressure - selector lever in D							
1st gear							
Idle	bar (psi)	6.0 – 7.5 (86 – 106)					
Kickdown	bar (psi)	9.0 – 11.0 (128 – 156)					
Engine speed	rpm	approx. 4,000					
2nd – 4th gears							
Idle	bar (psi)	4.6 – 5.6 (66 – 82)					
Kickdown	bar (psi)	7.0 – 9.0 (100 – 128)					
Reverse gear							
Idle	bar (psi)	11.0 – 13.0 (157 – 185)					
Kickdown	bar (psi)	17.0 – 20.0 (242 – 284)					
Converter pressure - selector lever in D and CL closed							
	bar (psi)	max. 0.7 (10)					
24 21 Input Shaft							
Axial play of input shaft		0.2 – 0.4 (0.008 – 0.016)					

24 - 315

24 31 . . . Primary pump

Designation		ZF - 4 HP - 22/EH
Radial play	mm (in.)	0.09 0.14 (0.0035 ... 0.0055)
Axial play	mm (in.)	0.03 0.06 (0.0012 ... 0.0024)

24 40 . . . Torque Converter

Diameter	mm (in.)	260 (10.236) 320 (K, 230 (9.055)
Code		W 3 320 (K, V 2
Stall speed	rpm	2200 ... 2400 320 (K, 2200 ... 2500 325 (A, 2100 ... 2300
Journal dia.	mm (in.)	32 (1.260)

24 61 . . . AEGS Control Unit

Code letter	see Parts Catalog
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24 61 . . . Downshift Prevention Control Unit

Bosch No.	0 260 002 022
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26 00 Propeller Shaft In General

Grease for slide

Longterm 2 *

Grease for constant velocity joints

Optimal *

Volume of grease for constant velocity joint

g

80

Explanation of Deflection Angles

Propeller shaft angled upwards = positive (+) deflection angle

Propeller shaft angled downwards = negative (-) deflection angle



PROPELLER SHAFT		3 Series E 30 Manual Transmission Engine M10 M40 M42 S14	3 Series E 70 Automatic Transmission Engine M10 M40 M42 S14
26 - 2			
26 11 , Propeller Shaft E 30			
Deflection torque of universal joints	Ncm	20 70	20 70
Preload of center mount in forward direction	mm	4 ... 6	4 6
Deflection angle Transmission - propeller shaft		- 0° 27' + 0° 33'	0° 25' + 0° 35'
Center mount		- 0° 48' + 0° 12'	- 0° 50' + 0° 10'
Propeller shaft / final drive		- 0° 10' + 0° 50'	- 0° 10' + 0° 50'

PROPELLER SHAFT

26 - 3

3 Series E 30**Manual Transmission**Engine
M20
M21**3 Series E 30****Automatic Transmission**Engine
M20
M21**3 Series E 30****Four Wheel Drive****26 11 - Propeller Shaft E 30**Deflection torque of universal
joints

Nm

20 ... 70

20 ... 70

20 ... 70

Preload of center mount in
forward direction

mm

4 ... 6

4 ... 6

—

Deflection angle

Transmission - propeller shaft

- 0° 47' ... + 0° 13'

- 0° 49' ... + 0° 11'

- 0° 42' ... + 1° 42'

Center mount

- 1° 10' ... + 0° 10'

- 1° 08' ... + 0° 08'

—

Propeller shaft / final drive

- 0° 10' ... + 0° 50'

- 0° 10' ... + 0° 50'

+ 0° 17' ... + 1° 17'

Transfer Box – All Wheel Drive**3 Series – E 30**

27 11

27 00 . . . Transfer Box in General**Oil grade**

approved ATF – see Service Information

Oil change volume (flows
out of filler plug bore) ltr. (US/imp. pts.)

0.5 (1.06/0.88)

New oil filling volume ltr. (US/imp. pts.)

0.53 (1.12/0.93) *

27 11 . . . Case and CoverVisco clutch locking torque
at 150 rpm Nm (ft. lbs.)

70 (51)

Temp. for bearing installation °C (°F)

80 (175)

27 21 . . . Transmission ShaftsAxial play between input and
output shafts at shim mm (in.)

0.4 0.6 (0.016 0.024)

Radial runout of output journal mm (in.)

0.07 (0.0028)

Axial runout of output flange mm (in.)

0.07 (0.0028)

23 71 . . . Transmission Bearings

Pressing-in force tons

2.4

* In case of a new filling, pour in part of
the oil volume = 0.06 ltr. (0.13 US/0.11
imp. pts.) through the removed vent.

FRONT AXLE

31 1

3 Series E 30

3 Series E 36

5 Series E 34

6 Series E 34

7 Series E 32

8 Series E 31

31 10 Front Axle and Suspension

Track width mm offset with car
loaded down to normal position
(see page 32-100)

mm

1405 35

1408 47
1418 42

1470 30 19

1429 22

1530 20
1532 19

1554 15

325 IX

1420 47

M3
1422 41

M 5

1474 20

M 635 CS1
1431 22850CS1
1564 10

M3

1412 30
1418 27

325IX

1468 54

Wheelbase

mm

2570

2703

2761

2679

2833

2667

325 IX
2571With power
steering
2698M3
27102500 1
2947

FRONT AXLE		3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30
31 - 2		Sedan	Conv	318iS 320iS-2	10i Long	320iS-4	4WD	M 3
31 10 Front Axle and Suspension								
Ride level height (lower edge of wheel house to rim flange at middle of wheel) with car loaded down to normal position (see page 32-100)		mm + 10						
	with 14" rim	565	570		568	565	565	
	with 15" rim	578	583		578	578	578	596
	with 16" rim							588
	with T10 rim	569	574		569	569	569	
M-Technik running gear	with 14" rim	550	550	545, AUS 557	545		550	
	with 15" rim	563	563	558, AUS 570	558		563	
	with T10 rim	554	554	549, AUS 561	549		554	
Without wheel house panel	with 14" rim						568	
	with 15" rim						581	
	with T10 rim						572	
M-Technik running gear without wheel house panel	with 14" rim						553	
	with 15" rim						566	
	with T10 rim						557	
Sport Evo	with 16" rim							572
Measuring and correcting car ride level height				refer to Model Repair Manual				
Max. deviation from nominal value for all wheels together		mm			10			

FRONT AXLE 31 - 3	3 Series E 35	3 Series E 35 M 3
31 10 . Front Axle and Suspension		
Ride level height (lower edge of wheel house to rim flange at middle of wheel) with car loaded down to normal position (see page 32-100) mm + 10 with 15" rim	575	
Sport running gear with lower position with 15" rim with 17" rim	581	
		585
Measuring and correcting car ride level height	refer to Model Repair Manual	
Max. deviation from nominal value for all wheels together mm	10	

FRONT AXLE		3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
31 - 7							
31 21 . Wheel Bearings							
Type		bearing units lubricated for entire service life and cannot be disassembled					
Max. axial runout of wheel hub mm		0,1					
31 31 . Spring Strut Shock Absorbers							
Amount of oil filled between spring strut and absorber cartridge (all approved grades of engine oil) – excluding gas pressure absorbers cm ³		20 25	—	518L, 520r 42 47	30 35	20 35	—
		325 RX 14 18		524nd 525r 20 25 525RX —			
Shock absorber test values		refer to Service Information of Gr. 37					

FRONT AXLE

3 Series E 30

5 Series E 34

6 Series E 34

31 - 8

before 1982 models

31 33 Springs

Important!

Only install pairs of springs with the same BMW number (located on end of spring) and same color code (either with or without stripe of red paint) on one axle.

Refer to the parts microfiche for a survey of springs to vehicle type and, if applicable, special equipment (such as: air conditioner, sport suspension, etc.) and date of introduction.

Part numbers can be determined with help of the BMW number on springs and therefore a spring found in the parts microfiche for a certain vehicle type.

Example

- 1 Spring with red color code
 number on spring, e.g. 1 125 332
 add 1 = part number 1 125 333
- 2 Spring without red color code
 number on spring, e.g. 1 125 332
 add 2 = part number 1 125 334

Also refer to Model Repair Manual.

31 - 9 Front final drive unit	3 Series E30	3 Series E 34	
31 50 Front differential unit			
Lubricant: see Specifications for Fuels, Fluids and Lubricants			
Capacity (initial filling) ltr.	0.7	0.7	
31 52 . . . Ring and pinion assembly			
Tooth pattern	Gleason	Gleason	
Number of teeth			
Ring/pinion = Conversion ratio	32S(X)* $49 / 11 = 3.64$ 32S(X Cat)* A touring (sp)* $49 / 11 = 3.91$ 32S(X A) $41 / 11 = 3.73$ 32S(X Cat)* A touring $41 / 10 = 4.10$	44/13 = 3.38	
Friction torque		FAO: 1.47 . 2.1	
Pinion bearings (new bearings) Nm	1.53 . 3.19	Timken: 1.25 . 2.65	
Shaft seal installed Nm	0.2	0.2	
Backlash mm	0.06 . 0.13	0.06 . 0.13	
* (sp) = Sports transmission			
* (cat) = catalytic converter			

FRONT AXLE		3 Series E 30	5 Series E 34	
31 - 10				
31 52 . . Differential				
Residual axial play of shaft gears	mm	0.01 ... 0.07	0.01 ... 0.07	
Differential bearing friction torque (new bearing)	Nm	1.18 ... 2.6	1.3 ... 2.6	
31 60 . . Output Shaft				
Design		with constant velocity joints	with constant velocity joints	
Grease filling for each joint	g/l	80	80	

STEERING AND WHEEL ALIGNMENT		3 Series F 30	3 Series E 30	3 Series F 30	3 Series E 30
32 - 1			M-Technic	Four Wheel Drive	Four Wheel Drive M-Technic
32 00 - Front Wheel Alignment					
See page 32 100 for testing conditions¹					
Total toe		0° 18' - 5'	0° 18' - 5'	0° - 5'	0° - 5'
Camber *		- 40' - 30'	- 1° 10' - 30/ 31.6% AUS¹	- 1° 30/ turning - 1° 30 ⁺¹³ -30	- 1° 20' - 30'
Toe difference angle * with 30° inside wheel lock		- 1° 40' - 30'	- 1° 50' - 30'	- 1° 10' - 30'	- 1° 10' - 30'
Kingspin inclination * with - 10° wheel lock		13° 52' - 30'	14° 32' - 30'	12° 40' - 30'	12° 40' - 30'
with - 30° wheel lock		14° 15' - 30'	14° 45' - 30'	12° 58' - 30'	12° 58' - 30'
Caster * with - 10° wheel lock		6° 30' - 30'	6° 46' - 30'	1° 33' - 30'	1° 33' - 30'
with - 30° wheel lock		6° 46' - 30'	6° 03' - 30'	1° 35' - 30'	1° 35' - 30'
Front wheel displacement		0° - 15'	0° - 15'	0° - 15'	0° - 15'
Maximum wheel lock inside wheel	approx	41.3°	41.3°	37.7	37.7
Outside wheel	approx	33.9	33.9°	33.8°	33.8
Approx. turning circle	m	10.5	10.5	11.1	11.1

* Deviation between left and right max. 30'

STEERING AND WHEEL ALIGNMENT	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30
32 - 2	Sedan touring 320iS-4	Convertible	M-Technic Sedan Convertible	M-Technic touring 320iS 2 316iS	4 Wheel Drive	4 Wheel Drive M-Technic
32.00 . Rear Wheel Alignment						
<i>See page 32.100 for testing conditions.</i>						
Total toe	0 - 22' ± 7'	0 - 23' ± 7'	0' 31' ± 7'	0' 18' ± 7'	0' 25' ± 7'	0' 30' ± 7'
Camber *	+ 2' ± 30'	+ 1' 50' ± 30'	+ 2' 30' ± 30'	+ 2' 20' ± 30' 318iS 40iS ¹ + 2' ± 30'	+ 2' ± 30'	+ 2' 30' ± 30'
Geometrical axis deviation	0' ± 15'	0' ± 15'	0' ± 15'	0' ± 15'	0' ± 15'	0' ± 15'

* Deviation between left and right max. 30'

STEERING AND WHEEL ALIGNMENT		M 3	M 3 Evo 90	
32 - 3				
32 00 . Front Wheel Alignment				
<i>See page 32 100 for testing conditions*</i>				
Total toe		0° 17' ± 5'	0° 17' ± 5'	
Camber °		- 42' ± 30'	- 55' ± 30'	
Toe difference angle ° with 20 inside wheel lock		- 1° 50' ± 30'	- 1° 51' ± 30'	
Koppin inclination ° with : 10° wheel lock		14° 11' ± 30'	14° 24' ± 30'	
	with : 20° wheel lock	14° 11' ± 30'	14° 24' ± 30'	
Caster ° with : 10° wheel lock		9° 8' ± 30'	9° 16' ± 30'	
	with : 20° wheel lock	9° 8' ± 30'	9° 16' ± 30'	
Front wheel displacement		0° ± 15'	0° ± 15'	
Maximum wheel lock inside wheel	approx	38°	38°	
	Outside wheel	approx 32,8°	32,8°	
Approx. turning circle		m 11.1	11.1	

* Deviation between left and right max. 30°

STEERING AND WHEEL ALIGNMENT

32 - 4

M 3

until 1989 models

M 3

since 1990 models

M 3 Evo 10

32-00 . Rear Wheel Alignment

*See page 32-100 for testing conditions**

Total toe

0° 34' - 7°

0° 28' - 7°

0° 28' - 7°

Camber *

- 2° 30' ± 30'

- 2° 20' ± 30'

- 2° 20' ± 30'

Geometrical axis deviation

0° - 15°

0° - 15°

0° - 15°

* Deviation between left and right max 30°

STEERING AND WHEEL ALIGNMENT

3 Series E 30

3 Series E 30

32 · 15

32 11 Steering Gear

Slip torque – steering gear
removed (within 360° = 1.2
steering wheel turn to each
side from middle position)

Nm

0.9 · 1.3

0.9 · 1.1

Outside of middle position

Nm

max. 2.0

max. 2.0

STEERING AND WHEEL ALIGNMENT	3 Series F 30	3 Series E 35	5 Series E 34 4WD	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
32 - 16							

32 13 . Power Steering Gear

Oil grade		see Operating Fluids					
Oil volume in hydraulic circuit	ltr	1.2	1.2	1.2	1.2	2.0	2.4
Oil volume in hydraulic circuit with ride level control	ltr	1.6		1.8	1.8	3.0	2.4
Ratio				14.5 MS 135	13.5	14.5	13.5
Friction torque rise in pressure point in comparison with torque outside of middle position	Nm			0.4 - 0.6	0.4 - 0.6	0.4 - 0.6	0.4 - 0.6
Friction torque outside of pressure point measured on Steering wheel max	Nm			1.4 MS 15	1.4	1.4	1.4
Steering gear max	Nm			1.0	1.0	1.0	1.0
New condition	Nm			0.9 - 1.2	0.9 - 1.2	0.9 - 1.2	0.9 - 1.2
Friction torque in pressure point measured on Steering wheel	Nm			1.3 - 1.8 MS 16 - 22	1.2 - 1.8	1.2 - 1.8	1.2 - 1.8
Steering gear	Nm			1.0 - 1.4	1.0 - 1.4	1.0 - 1.4	1.0 - 1.4
New condition	Nm			1.8 - 2.0	1.8 - 2.0	1.8 - 2.0	1.8 - 2.0

STEERING AND WHEEL ALIGNMENT		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
32 - 17							
32 41 High Pressure Power Steering Pump Tandem Pump							
Rated pressure (with engine running at idling speed)							
Impeller pump	max. bar	110 - 120	110 - 120	130 ± 10 4WD 110 ± 10	100 - 120 M 635 CSi 110 - 120	130 ± 10	130 ± 10
Piston pump	min. bar			120 4WD 200		120	200

STEERING AND WHEEL ALIGNMENT

3 Series E 30

3 Series E 36

5 Series E 34

6 Series E 34

7 Series E 32

8 Series E 31

32 - 18

32 41 Narrow Ribbed Drive Belt

Designation

316 316T
9.5 x 800320T
9.5 x 810325T
9.5 x 825324d/td
9.5 x 865M 40
9.5 x 730M 50
6K x 1560M57
5 PK x 1815M 30
9.5 x 865M 20
9.5 x 820M 5
9.5 x 825M 50
6K x 1560M57
5 PK x 1815

9.5 x 900

9.5 x 865

M 70
6 K x 1000

6 K x 1080

STEERING AND WHEEL ALIGNMENT

32 - 100

All Models except for

E 24
E 31
Convertible
M 3
M 5

Testing Conditions for Wheel Alignment

Car loaded down to normal position	Car with complete equipment for normal driving with 2 x 68 kg on front seats (seats in middle position), 1 x 68 kg on rear seat (middle), 1 x 21 kg in trunk (middle) and full fuel tank.	Car with complete equipment for normal driving with 2 x 68 kg on front seats (seats in middle position), 1 x 14 kg in trunk (middle) and full fuel tank
Wheel Alignment Test Conditions		
1. Specified rims and tires	see Group 36	see Group 36
2. Uniformly worn tire treads		
3. Specified tire pressure	see label on car	see label on car
4. Specified wheel bearing play	see Group 31	see Group 31
5. Check car ride level height in normal position (see above). <i>important!</i> Repair car if value deviates from specifications (refer to Repair Manual).	refer to Groups 31 / 33,	refer to Groups 31 - 33,
6. Specified car ride level height	Specified height + 2 mm, refer to Groups 31 / 33, adjust by loading or unloading car	Specified height + 2 mm E 36 M 3 ± 1 mm, refer to Groups 31 - 33, adjust by loading or unloading car

REAR AXLE

33 - 1

3 Series E 30

3 Series E 35

5 Series E 34

6 Series E 24

7 Series E 32

8 Series E 31

33 00 Rear Axle In General

Track width / rim offset with car loaded down to normal position (see page 32-100)

mm

1399 - 35

325iX:
1404 / 47

M 3
1424 / 30
1430 / 27

1431 / 42
1421 / 47

M 3:
1444 / 41

1495
/ 20 19 / 54

M 5:
1496 / 20

1432 / 22

1558 30 19

1562 - 15

650 CSI
1554 / 19

REAR AXLE		3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30	3 Series E 30
33 - 2		Sedan	Convertible	318iS 320iS 2	touring	320iS-4	4 Wheel Dr	M 3
33 00 Rear Axle and Suspension								
Ride level height (lower edge of wheel house to rim flange at middle of wheel) with car loaded down to normal position (see page 33-100)		mm + 10						
with 14" rims		505	510		505	505	510	529 511
with 15" rims		518	523		518	518	523	
with 16" rims								
with TD rims		509	514		509	509	514	
M-Technic running gear with 14" rims		490	490	495, 500 AUS	495		495	
with 15" rims		503	503	508, 513 AUS	508		508	
with TD rims		494	494	499, 504 AUS	499		499	
Without wheel house panel with 14" rims							513	
with 15" rims							526	
with TD rims							517	
M-Technic running gear without wheel house panel with 14" rims							498	
with 15" rims							511	
with TD rims							502	
Sport Evo with 16" rims								541
(Refer to Group 31 in Model Repair Manual for instructions on measuring the ride level height.)								
Max. deviation from nominal value among all wheels		mm		10				

33 - 7 Final drive unit		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
33 10. Types K/M/G differential unit	Lubricant	see Specifications for Fuels, Fluids and Lubricants	see Specifications for Fuels, Fluids and Lubricants	see Specifications for Fuels, Fluids and Lubricants	see Specifications for Fuels, Fluids and Lubricants	see Specifications for Fuels, Fluids and Lubricants	see Specifications for Fuels, Fluids and Lubricants
	Capacity according to differential type* approx. ltr	K 316 324d 0.9	K 316 320 1.1	M 316 320 1.7	G 1.9	M 1.7	G 1.9
		M 324d .. M 3 1.7	M 324d M 3 1.7	G 325 M 5 1.9		G 1.9	G 850CS 1.9
							(initial filling with cooling circuit 2.7 ltr.)

* Type K

= Four-bolt side cover

Type M

= Six-bolt side cover

Type G

= Eight-bolt side cover

33 - 8 Final drive unit	3 Series E30 4-door sedan	3 Series E30 Touring	3 Series E30 Convertible
33 12 Final-drive conversion ratios 3 Series E 30			
316	3.91		
316i	4.16 / from 09/88 4.27	4.27	-
316A	3.91	4.45	
316i	4.10		
316i Cat	4.10	4.27	4.27
316A Cat	4.45	4.45	4.45
316A Cat Switzerland/Austria	-	-	4.10
316ia	4.10	-	
320i	4.10	4.27	4.27
320A	4.45	4.45	4.45

33 - 9 Final drive unit	3 Series E30 4-door sedan	3 Series E30 Touring	3 Series E30 Convertible
30 12 Final-drive conversion ratios 3 Series E30			
324d	3.45	-	-
324dA	3.45	-	-
324td	3.25	3.25	-
324tdA	3.25	3.25	-
325i	3.73	3	3.73
325i with Sports transmission	3.91		3.91
325iA	3.73	3	3.73
325iA USA/Canada/Australia	-	-	4.10
325iA Japan	-	.10	
325iX	3.64	-	
325iX with Sports transmission	3.91	-	-
325iXA	3.73	-	-
325iX at Cat	3.91	3.91	-
325iXA at Cat	3.91	4.10	-
325iXA Switzerland/Austria	-	3.91	
325iXA Scandinavia		3.91	
M3	3.25	-	3.25
M3 Evo.0711	3.15 / Conversion to 3.25 possible	-	-

REAR AXLE	3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
33 - 18						

33 12 ... Drive Pinion and Backlash		
Backlash	mm	0.06 ... 0.14
Ring gear installing temperature	°C	80 ... 180
Max. input flange radial runout	mm	0.07
Approx. shaft seal friction torque	Nm	0.35

33 - 19 Final drive unit			3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
Pinion bearing friction torque, according to differential type (see front) and bearing manufacturer								
Note								
Thoroughly lubricate bearings with differential lubricant*, allowing excess to drip off								
K	FAG	Nm	1.60 - 2.36					
	SKF	Nm	1.40 - 2.60					
	Timken	Nm	1.45 - 2.65					
	Koyo	Nm	1.27 - 2.65					
M	FAG	Nm	1.50 - 1.36					
	SKF	Nm	1.50 - 2.50					
	Timken	Nm	1.25 - 3.40					
	Koyo	Nm	1.23 - 2.73					
G	FAG	Nm	2.20 - 5.19					
	SKF	Nm	2.00 - 4.30					
	Timken	Nm	2.30 - 5.15					
	Koyo	Nm	2.38 - 4.78					
* See BMW Specifications for Fuels, Fluids and Lubricants								

REAR AXLE		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
33-20							
33-13 Differential							
Play between diaphragm spring shim and differential side gear	mm	0.03 ... 0.1	0.03 ... 0.1	0.03 ... 0.1	0.03 ... 0.1	0.0 ... 0.07	0.0 ... 0.07
		3250X: 0.03 ... 0.08					

Friction torque on differential casing bearings (both), according to differential type (see front) and bearing manufacturer

Note

Thoroughly lubricate bearings with differential lubricant¹, allowing excess to drip off

K	FAG	Nm	1.18	2.62
	SKF	Nm	1.29	2.99
	Timken	Nm	1.29	2.60
	Koyo	Nm	1.29	2.62

M	FAG	Nm	1.19	2.44
	SKF	Nm	1.00	2.00
	Timken	Nm	0.70	2.56
	Koyo	Nm	1.40	2.60

G	FAG	Nm		
	SKF	Nm		
	Timken	Nm	1.80	3.80
	Koyo	Nm	1.40	3.40

¹ See BMW Specifications for Fuels, Fluids and Lubricants

REAR AXLE		3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 34	7 Series E 32
33-22						
33-14 Final Drive with Limited Slip Differential						
Slip torque with one each differential side gear held tight and driven plates lubricated with approved final drive gear lube)	Nm	30 ... 50	30 ... 50 3240d ... M 3- 50 ... 75	50 ... 75	50 ... 75	110 ... 130
Optional outer plate thickness	mm	1.9 / 2.0 / 2.1				
Inner plate thickness	mm	2.0				
33-19 Electro-hydraulic Limited Slip Differential						
Minimum gas charging pressure in pressure reservoir	bar			325i 4WD: 25		

19-21

3 Series E 30

15/05/2014 11:38

9.5.2013 11:34

6 September 2004

7 Series E 33

E 37

23 21	Output Shift
-------	--------------

Grease lling for each joint
(grease supplied with "dust
cover" repair kit)

60

120

ECE
140

AF 3.
Final dr and
85
Wheel end
100

Final drive
and
85
Wheel and
100

Cement for dust covers

Donnik 1913
red / Epplo
4841 red

Beaujolais, 1972
red / Apple
4841 red

Sealing compound for end covers
and protective caps

Cur T /
Siucan
Dicht-Gel 3084

Curt T.
Stucchi
cst-001-2090

Carl T. Stewart
Biology-Gal 3090

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Carl T.
Stueck
Eich-Gel 309M

Quell-T
Stück
Dicht-Gel 200M

REAR AXLE		3 Series E 30	3 Series E 36	3 Series E 34	5 Series E 34	7 Series E 32	8 Series E 31
33 34							
33 41 Wheel Bearings							
Double-row, angular ball bearing lubricated for service life and not to be disassembled							
Max. axial wheel bearing play	mm	0.05 ... 0.1	0.05 ... 0.08	0.06 ... 0.08	0.06 ... 0.08	0.06 ... 0.08	0.06 ... 0.08
33 52 Shock Absorbers							
Shock absorber test values		refer to Service Information of Gz 37					

Important!

Install only pairs of springs with same BMW number (located on end of spring) and same color code (either with or without stripe of red paint) on one axle.

Refer to the parts microfiche for a survey of springs to vehicle type and, if applicable, special equipment (e.g. air conditioner, sport suspension, etc.) as well as introduction dates.

The BMW number on the spring can be used to determine the part number and therefore springs on the parts microfiche belonging to a car.

Example:

1. Spring with red color code
 number on spring, e.g. = 1 125 336
 add 1 for part number = 1 125 337
2. Spring without red color code
 number on spring, e.g. = 1 125 336
 add 2 for part number = 1 125 338

BRAKES		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
34 - 1							
34 00 Brakes In General							
Brake fluid		refer to Operating Fluids					
Leak test with engine stopped. If applicable discharge vacuum reservoir by operating brake pedal firmly about 10 times							
Approx. force on pedal	N	500	500	500	675	500	500
Equal to approx. line pressure	bar	45 <i>since 4.87: 60</i>	38 <i>M 3: 32</i>	34	50	34 <i>H 31 system: 30</i>	25
Max. pressure drop within 2 min.		8 %	8 %	8 %	8 %	8 %	8 %
Brake booster function test (with engine running)							
Force on pedal	N	200	200	200	200	200	200
Line pressure	bar	70 - 80 <i>since 4.87: 60 - 70</i>	9" Mastervac (LSC 85) 50 ... 60 12" Mastervac (LSC 88) 60 ... 73 <i>M 3: 50 ... 60</i>	70 ... 90	70 ... 90	70 ... 90 <i>H 31 system: 75</i>	75

BRAKES		3 Series E 30	6 Series E 34
34 - 2			
34 11 - Front Wheel Brakes			
Brake pads	Type	Textar T 444 LSA: Jurid 505 M 3: Jurid 505 LSA: Energil 582	Jurid 505
Min. pad thickness without backplate	mm	2.0	
Brake disc minimum thickness (MIN TH) is stamped in brake disc shell	mm	solid: 11.1 vented: 20.4 M 3: 23.4	23.4
Maximum machining limit per friction ring side (M-models may not be machined)	mm	0.8	0.8

BRAKES		3 Series E 30	6 Series E 24
34 - 5			
34 11 ... Front Wheel Brakes			
Max. thickness deviation within braking surface	mm	0.02	
Max. axial runout of braking surface (measured on largest diameter of braking surface)			
Disc installed	mm	0.2	
Disc removed	mm	0.05	
Surface finish of braking surfaces (fine ground)	Ra μ	1.5 ... 3.5	
Brake disc diameter	mm	260	282
			M 635 (CS): 330

BRAKES		3 Series E 30	5 Series E 34
34 - 7			
34-21 ... Rear Wheel Brakes (Discs)			
Brake pads	Type	Jurid 508 USA: Jurid 508* M3: Jurid 547 USA: Energ® 582	Jurid 508
Min. pad thickness without backplate	mm	2.0	
Brake disc minimum thickness (MIN TH) is stamped in brake disc shell	mm	8.4 3250X touring: 18.4	8.4
Maximum machining limit per friction ring side (M-models may not be machined)	mm	0.8	0.8

BRAKES		3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
34 - 10							
34 21 ... Rear Wheel Brakes (Discs)							
Max. thickness deviation within braking surface	mm	0.02					
Max. axial runout (measured on largest diameter of braking surface)							
Disc installed	mm	0.3					
Disc removed	mm	0.05					
Surface finish of braking surface (fine ground)	Ra, µ	0.5 ... 3.5					
Brake disc diameter	mm	258 3251X touring: 255	280 M3: 312	300	272	300	324 890CS: 320

BRAKES	3 Series E 30	3 Series E 35	5 Series E 34
34 - 11			

34 21 ... Rear Wheel Brakes (Drums)

Brake liners (always use same type liners only on one axle)	Type	Energil 551 FF	Energil 551 FF	Energil 550
Machining level "final size" (always machine both drums of one axle)	mm	229.5	229.5	254.0
Min. liner thickness	mm	1.5	1.5	1.5
Max. radial runout of braking surfaces	mm	0.05	0.05	0.05
Surface finish of braking surfaces (fine ground)	Ra μ	1.5 .. 3.5	1.5 .. 3.5	1.5 .. 3.5

BRAKES

34 - 12

3 Series E 30

3 Series E 36

5 Series E 34

6 Series E 24

7 Series E 32

8 Series E 31

34 33 ... Brake Booster

Simple Mastervac

Type

T52-3/255
since 4.87:
T52-4/2554 cyl.
LSC 65

6 cyl.:
LSC 80*with ABS:*
T52-4A/255

LSC 80

Tandem Mastervac

Type

4 wheel drive:
8" 5" LSC115TM 5, towing,
4WD:
LSC 115 LT26 cyl., 8 cyl.,
LSC 115 LT2

Power flow regulator with reservoir

Max. operating pressure in
steering circuit

bar

130

130

130

Upper switching pressure

bar

52 ... 57

52 ... 57

52 ... 57

Lower switching pressure

bar

36 ... 41

36 ... 41

36 ... 41

BRAKES		3 Series E 30	3 Series E 35	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
34 - 13							
34 41 . Parking Brake							
Parking brake drum diameter	mm	150,8	160 M 2 - 180	180	180	180	180
Max. radial runout of braking surface	mm	0,1					
Surface finish of braking surface (fine ground)	Ra µ	1,5 ... 3,5					
Min. brake liner thickness	mm	1,5					

BRAKES		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
34 - 14							

34 50 .. ABS

Additional information

refer to Nominal Value microšche

34 51 .. Hydraulic Control Unit

Hydr. control unit for ABS	Code	0 265 100 013	34 51-1 158403	0 265 201 022	0 265 201 009	0 265 201 020	0 265 201 020 0 265 201 022
		<i>M 3:</i> 0 265 200 035	<i>since 05.92:</i> 34.51-1090428 <i>M 3</i> 34 51-2227215		<i>M 635 CSI:</i> 0 265 201 008	<i>F50V:</i> 0 265 201 022	
Hydr. control unit for ABS/ASC + T	Code		34 51-1090700			0 265 106 013	0 265 106 013
Distance (A) between signal sender and pulse wheel (without bearing clearance)							
	Front	mm	0.18 .. 0.71	0.18 .. 0.71	0.18 .. 0.71	0.18 .. 0.71	0.13 .. 0.91
Rear	mm	0.15 .. 0.88		0.15 ... 0.88	0.15 .. 0.88	0.15 .. 0.88	0.06 .. 0.89

BRAKES

34 - 15

3 Series E 30

3 Series E 36

5 Series E 34

6 Series E 24

7 Series E 32

8 Series E 31

34 52 Electronic Control Unit

ABS	Code	0 265 103 004 since 88- 0 265 103 041 325HX 0 265 105 011. 019		0 265 100 045/ 049	0 265 100 021	0 265 100 045/ 049	0 265 100 045/ 049
ABS-ASC	Code					0 265 106 003	0 265 106 003
ABS-ASC + T	Code					0 265 106 005 0 265 106 013	0 265 106 003 0 265 106 013

PEDALS		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
35 - 1		a) M 20 engine b) M 40 engine					
35 21 . . Brake Pedal							
Distance A' from lower edge of pedal to firewall	mm	235 ^{+ 10}	225 ^{+ 10}	245 ^{+ 10}	248 ^{+ 10}	245 ^{+ 10}	245 ^{+ 10}
Brake light switch adjusting distance B*	mm	6 - 8,6	—	6 - 8,6	6 - 8,6	6 - 8,6	—
Max. pull rod - reversing lever - stop distance A*	mm	—	—	0.5	—	0.5	—
35 31 . . Clutch Pedal							
Distance B* from lower edge of pedal to fire wall	mm	253 ^{+ 11}	260 ^{+ 10}	265 ^{+ 10}	271 ^{+ 11}	265 ^{+ 10}	259 ^{+ 10}
Over-center helper spring adjusting distance C*	mm	a) 33 b) —					

Specified distances are only reference values and do not consider installation tolerances. Distances without consideration for carpets.

* Refer to Repair Manual for checkpoints.

PEDALS		3 Series E 30	3 Series E 35	5 Series F 34	6 Series E 24	7 Series E 32	8 Series E 31
35 + 2		a) M 20 engine b) M 40 engine					
35 41 . . . Accelerator Pedal							
Full load stop screwed adjusting distance C*							
Manual transmission	mm	a) 52 b) 52	52	46	46	46	46
Automatic transmission	mm	a) 60 b) 51	54	54	51	54	54
EH transmission	mm	a) 60 b) ---	51	51	51	51	51
Lubricant for bearings		Renocal FM 745 from Fuchs in Mannheim Gilsando from VW 745 from Texaco					

Specified distances are only reference values and do not consider installation tolerances
Distances without consideration for carpets

* Refer to Repair Manual for checkpoints

PEDALS			3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
35 - 3								

Control Distances for Pedals

Spacing between accelerator pedal and brake pedal								
Manual transm	J*	mm	50	50	65	65	65	65
Autom. transm	K*	mm	62	60	60 + 10	71	60 + 10	70
Spacing between tunnel and brake pedal								
Manual transm	F*	mm	132	135 ± 5	144	143	144 ± 5	144 ± 5
Autom. transm	G*	mm	144	145 ± 5	140 ± 10	156	150 ± 5	150 ± 5
Spacing between brake pedal and clutch pedal			mm	50	50	50	50	50
	H*							

Specified distances are only reference values and do not consider installation tolerances.
Distances without consideration for carpets.

* Refer to Repair Manual for checkpoints.

PEDALS			J Series E 30		
35 - 1 R			RHD		
35 21 Brake Pedal Distances					
Control distance	A	mm	273		
Pedal travel	C	mm	174 ± 9		
35 21 Pull Rod Distances					
Min. screwed-in depth A		mm	21 ± 1		
Basic setting	B	mm	732.5 ± 1		
Auxiliary distance	C	mm	639.5 ± 1		
Distance from bore to end of pivot	D	mm	41.5		
35 31 Clutch Pedal Distances					
Control distance	D	mm	269 ± 11		
Pedal travel	E	mm	151 ± 11		
35 41 Accelerator Pedal Distances					
Control distance	C	mm	Manual Transmission	Automatic Transmission	Elec. Hydr. Transmission
M20 engine		mm	55	51	51
M40 engine		mm	47	53	

Pedal Side Spacing Control Distances

Distance from tunnel to clutch pedal F	mm	128 ± 5
Distance from tunnel to brake pedal G	mm	187 ± 5
Distance between clutch and brake pedals H	mm	52
Distance between brake and accelerator pedals J	mm	52
Lubricant for bearing surfaces		Renocal FN 745 from Fuchs in Mannheim

Wheel Rims and Tires 36 - 1	Steel Rims All Models	Aluminum Rims All Models
36 10 ... Wheels		
Max. radial runout of tire (rim with tire)	mm (in.) 2.0 (0.079)	1.6 (0.063)
Max. axial runout of tire (rim with tire)	mm (in.) 2.0 (0.079)	1.6 (0.063)
Max. radial runout of rim	mm (in.) 1.0 (0.039)	0.6 (0.024)
Max. axial runout of rim	mm (in.) 1.0 (0.039)	0.6 (0.024)
Max. dynamic imbalance for each wheel	g/cm 100	
Max. imbalance for each side	g 90	
Elimination of imbalance	up to 60 g with one weight or more than 60 g with two weights	
Approved rims and tires	see Service Information of Group 36	

INTEGRATED SUSPENSION SYSTEMS		3 Series E 30	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
37 - 1						

37 00 - General Data

Oil grade		refer to Operating Fluids	refer to Operating Fluids	refer to Operating Fluids	refer to Operating Fluids	refer to Operating Fluids
Approximate oil volume	litre	Circulating system 1.6	LAD/Circulating system 2.75	Hydraulic control unit 1.5	Hydraulic control unit 1.5	
				LAD/Circulating system 3.0	LAD/Circulating system 3.0	
Weight to adjust - check car ride level height	kg	200	200 fouring 280		200	

INTEGRATED SUSPENSION SYSTEMS			3 Series E 30	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
37 - 2							
37 12 - Regulating Rod							
Basic length	mm		154 ± 1		139 ± 0,5	277,5 ± 0,5	
37 12 - Shock Absorbers							
Shock absorber test		refer to Service Information for shock absorber test values					
37 12 - Ride-Level Height Control Valve							
LAD Circulating System							
Pressure	P max	bar	120 ± 5	120 ± 5	120 ± 5	120 ± 5	
	P min.	bar	30 ± 3	30 ± 3	30 ± 3	30 ± 3	

INTEGRATED SUSPENSION SYSTEMS		3 Series E 30	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
37 - 4						
37 31 ... Pressure Reservoirs						
Charging pressure at 20° C	bar	23 ± 0,5	23 ± 0,5	23 ± 0,5	23 ± 0,5	
37 31 ... LAD / Circulating System Pump						
Max. pressure at 20° C oil temperature	bar	> 120	> 120	> 120	> 120	
Circulating pressure at 20° C oil temperature	bar	20 ... 30	20 ... 30	20 ... 30	20 ... 30	
61 31 ... Hydraulic Switch - Hydraulic Control Unit						
Switching points						
High pressure	bar	110 ± 12	110 ± 12	110 ± 12	110 ± 12	
Low pressure	bar	28 ... 34	28 ... 34	28 ... 34	28 ... 34	

51 Cements, Sealing Compounds

ARCILLA sheets on doors, carpets
(only E 30 and E 34)

HWB Universal Cement

Weatherstrips on doors and trunk lid

HWB Profile Rubber Cement
HWB Fast Drying Cement

Paintable seams

HWB Body Sealing Compound

Sheet metal screwed connections

Sealing Tape

Undercoating

BMW Undercoating from HWB
3 M Body Plast (anti-drumming effect) from HWB

Body protection for bores, damaged
paint finish etc.

BMW Primer - BMW Parts Microfiche

Window cement
(only E 30 - M 3, E 34, E 32)

Window Cement Repair Kit from HWB

Window repairs (stone damage)

Window Repair Kit from HWB

Rubber and plastic parts
Hinges and door locks

Silicone Spray from HWB

Key holder light

Varta V 625 U 1.5 V 100 mA/h

Infrared sender (only E 32)

Varta V 625 PX 1.35 V 350 mA/h

ELECTRICAL SYSTEM	3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
61 - 1						

61 20	Battery					
Rated voltage	V					
	12					
Capacity in Ah						
(cold testing current in A)	48 (250)	48 (250)	50 (265)	66 (300)	84 (410)	65 (300)
	50 (265)	50 (265)	75 (388)	90 (450)	85 (410)	
	66 (300)	65 (300)	65 (410)		92 (450)	
	90 (450)	75 (388)				
		85 (410)				

ELECTRICAL SYSTEM		3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 34	7 Series E 32	8 Series E 31
61 + 2							
61 31 Switches							
Oil pressure switch							
Switching-on pressure	bar	0.2 ... 0.5					
Temperature switch for additional fan		optionally double temperature switch or single switches					
Double temperature switch							
Switching-on temp. - stage I/II	°C	93 + 3 / 103 + 3					
Switching-off temp. - stage I/II	°C	89 + 3 ... 99 + 3					
Temperature switch 91 °C							
Switching on/off temperature	°C	91 + 2 ... 94 + 2					
Temperature switch 99 °C							
Switching on/off temperature	°C	99 + 2 ... 92 + 2					

ELECTRICAL SYSTEM			3 Series E 30	3 Series E 36	5 Series E 34	6 Series E 24	7 Series E 32	8 Series E 31
61 - 3								
61 31 . Switches								
Door lock heating control unit			- 15 / 27 .. 35 0 / 13 .. 10 + 25 .. 5 .. 7	Central lock module controlled	Central body electronic controlled	- 15 / 27 .. 35 0 / 13 .. 10 + 25 .. 5 .. 7	Central body electronics controlled	Central body electronics controlled
Outside temp. in °C/heating time in sec								
Current consumption of door lock heating ring			A	3 .. 6	approx. 7	approx. 7	3 .. 6	approx. 7
Brake pad wear sensors								
Warning with pad thickness of								
at least	mm					1.5		
maximum	mm					3.5		
61 66 Windshield Washing Fluid Pump								
Min. delivery pressure			bar			1.5		
61 67 . . Headlight Washing Fluid Pump								
Fog lamp/headlight pump								
at least	bar			2.5 - 0.5	2.5 - 0.5		2.5 - 0.5	2.5 - 0.5
Dual pump								
left/right running	at least	bar		2.5 - 0.5	2.5 - 0.5		2.5 - 0.5	2.5 - 0.5

62 11 Coding Plug

Coding number

(refer to Parts Catalog for part numbers)

316 (only Belgium)

01

316i Car / Car V

03

324d (as replacement)

05

325i 4WD Conv

10

M 3

11

320i without Car/Conv

15

*320i Car**325i Car / Conv*

15

324td 324 d

16

318i Car

18

M 635 CSI

07

635 CSI, 635 CSI Car

19

INSTRUMENTS

62 - 2

All Models**except for****3 Series E 30 and 6 Series E 24****62 11 .. Coding Plug****Coding number****Coding via self-diagnosis — refer to Test Plan**

INSTRUMENTS	3 Series E 30	3 Series E 36	5 Series E 34
62 - 3			

62 12 . Speedometer

Display range	km/h	200	240/260	220/240	240	260/280
Distance pulse K	Pulse/km	4 878	4 838	7 712	4 851	4 534
Displayed value/frequency	km/h - Hz	40/54	40/54	40/52	40/52	40/50
		80/108	80/108	80/104	80/103	80/101
		120/163	120/161	120/157	120/156	120/151
		160/217	160/215	160/209	160/207	160/202
		200/271	200/269	200/281	200/258	200/252
		240/326		240/313	240/310	240/302

LIGHTS		3 Series E 30	3 Series E 36	5 Series E 34
63 1				
63 12 Headlights				
Light bulb for low beam ECE	Type	H 1 12 V 55 W	H 1 12 V 55 W	H 1 12 V 55
Light bulb for low beam USA	Type	9006	9006	9006
Light bulb for high beam ECE	Type	H 1 12 V 55 W	H 1 12 V 55 W	H 1 12 V 55 W
Light bulb for high beam USA	Type	9005	9005	9005
Light bulb for parking light	Type	H L 12 V 4 W	W 10/5 12 V 5 W	W 10/5 12 V 5 W
63 13 Front Turn Signals				
Light bulb ECE	Type	P 25-1 12 V 21 W	P 25-1 12 V 21 W	P 25-1 12 V 21 W
Light bulb USA	Type		12 V 21/5 W	12 V 21/5 W
63 13 Additional Front Turn Signals				
Light bulb ECE	Type	W 10/5 12 V 5 W	W 10/5 12 V 5 W	W 10/5 12 V 5 W
63 17 Front Fog Lamps				
Light bulb ECE	Type	H3 Y C 12 V 55 W	H 1 12 V 55 W	H 1 12 V 55 W
Light bulb USA	Type	9006	9006	9006

LIGHTS		3 Series E 30	3 Series E 36	5 Series E 34
63-3				
63-21 Tail Light Assemblies				
Light bulb - brake light	Type	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W
Light bulb - turn signal	Type	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W
Light bulb - tail light	Type	R 19-10 - 12 V 10 W	R 19-10 - 12 V 10 W	R 19-5 - 12 V 5 W
Light bulb - rear fog light	Type	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W
Light bulb - backup light	Type	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W	P 25-1 - 12 V 21 W
63-26 License Plate Lights				
Light bulb	Type	C 11 - 12 V 5 W	C 11 - 12 V 5 W	C 11 12 V 5 W

LIGHTS		3 Series E 30		3 Series E 36		5 Series E 34	
63 - 5							
63 31 Interior Lights							
Inside reading lamp front	Type			halogen 12 V 10 W			
Inside reading lamp rear	Type			soffit 12 V 10 W			
Pass. compartment lamp front	Type			soffit 12 V 10 W		soffit 12 V 15 W	
Pass. compartment lamp rear	Type			soffit 12 V 5 W		K - 12 V 10 W	
Pass. compartment lamp	Type	K - 12 V 10 W					
Trunk light	Type	C 11 - 12 V 5 W		soffit 12 V 10 W		K - 12 V 10 W	
Glove box light	Type	a) T 8/4 - 12 V 4 W b) C 11 - 12 V 5 W		soffit 12 V 5 W		C 11 - 12 V 5 W	
Engine compartment light	Type	L - 12 V 5 W		soffit 12 V 10 W		L - 12 V 5 W	
Symbol light bulbs	Type	W 12/1.2 - 12 V 1.2 W		W 12/1.2 - 12 V 1.2 W		W 12/1.2 - 12 V 1.2 W	
LCD module display	Type					W 5/1.2 - 12 V 1.2 W	
Footwell entrance lamp	Type						
Make-up light	Type			soffit 12 V 5 W			

HEATER AND AIR CONDITIONER 64 - 1	3 Series E 30	3 Series E 36	5 Series F 34
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64 11 . Control Unit

Code		see Parts Catalog	see Parts Catalog	see Parts Catalog
Operating voltage	V	0 ... 15	0 ... 15	0 ... 15
Control range	°C	14.5 - 3 ... 55.5 - 4.5		14.5 - 3 ... 55.5 - 4.5
Timing (for water valve)	sec.	3.3 ± 0.7	3.6	3.3 ± 0.7

HEATER AND AIR CONDITIONER 64 - 3	3 Series E 30	3 Series E 36	5 Series E 34
64 11 . Inside Temperature Sensor			
Code (without air conditioner)	see Parts Catalog		see Parts Catalog
Resistance depending on temperature °C/°F:	0 / 32.4 ... 37.7 5 / 24.8 ... 28.9 10 / 19.4 ... 22.1 15 / 15.1 ... 17.3 20 / 12.0 ... 13.3 25 / 9.5 ... 10.5 30 / 7.5 ... 8.4 35 / 5.9 ... 6.8 40 / 4.7 ... 5.4		0 / 32.4 ... 37.7 5 / 24.8 ... 28.9 10 / 19.4 ... 22.1 15 / 15.1 ... 17.3 20 / 12.0 ... 13.3 25 / 9.5 ... 10.5 30 / 7.5 ... 8.4 35 / 5.9 ... 6.8 40 / 4.7 ... 5.4
Resistance between connections 1 and 3 (PTC resistance) only at 25° C (only with air conditioner)	24.5 ... 42		24.5 ... 42

HEATER AND AIR CONDITIONER	3 Series E 30	3 Series E 36	5 Series E 34
64 - 5			

64 11 - Heater Temperature Sensor

Code	see Parts Catalog		
Resistance depending on temperature °C/kΩ	- 20	84.39	109.61
	- 10 /	48.58	62.09
	0 /	28.89	36.40
	20	11.13	13.83
	25 /	9.00	11.00
	60	3.19	2.78
	100	0.58	0.77

64 Intake Air Temperature Sensor

Code	1 378 850		
Resistance depending on temperature °C/kΩ	0	2.68	3.48
	10 /	1.74	2.11
	20	1.15	1.32
	25	0.95	1.05
	30	0.76	0.87
	35	0.76	0.87
	40	0.48	0.60

HEATER AND AIR CONDITIONER		3 Series E 30	3 Series E 35	5 Series E 34
64 - 7				
64 11 Blower Motor				
Code		see Parts Catalog	see Parts Catalog	see Parts Catalog
Testing voltage	V	13 ± 0.25	13 ± 0.25	13 ± 0.25
Operating voltage	V	9 ... 15	9 ... 15	9 ... 15
Approx. current consumption	A	12	29	12
Maximum speed	rpm	3600 ... 4000	3600 ... 4000	3600 ... 4000
Max. axial play	mm	1.0	1.0	1.0

HEATER AND AIR CONDITIONER		3 Series E 30	3 Series E 36	5 Series E 34
64 - 15				
64 50 Air Conditioner In General				
Refrigerant volume R 12 *	g	975 ± 25	1200 ± 25	1925 ± 25
		M 3: 975 ± 25	—	M 5, M 1500 ± 25
R 134 a *	g	800 ± 25	1000 ± 25	with round pipe condenser: 1550 ± 25 with flat pipe condenser: 1450 ± 25
Min. charging pressure	bar	10	10	10
Refrigerant machine-oil R 12		81 22 9 407 028 *	81 22 9 407 028 *	81 22 9 407 028 *
R 134 a		81 22 9 407 724 *	81 22 9 407 724 *	81 22 9 407 724 *
Volume for R 12 compressors Drum-type compressor	cm ³	300	—	300
Impeller-cell compressor	cm ³	200	200	200
for R 134 a compressors Nippondenso	cm ³	—	120 ± 20	180 ± 20
Seko Seiki	cm ³	—	120 ± 20	160 ± 20
Solenoid clutch current consumption	A	3.3	3.3	3.3

* Source of Reference: Parts and Accessories Catalog

64-50 ... Air Conditioner In General

Amount of refrigerant machine oil
filled after replacement of

Drier	g	10
Evaporator	g	approx. 40
Condenser	g	50
Pipe	g	approx. 10

64 - 18

64 51 ... Evaporator Sensor

Resistance depending on
temperature

°C/kΩ

- 5	/	11.4	...	11.9
0	/	8.8	...	9.2
5	/	6.8	...	7.2
10	/	5.3	...	5.6
15	/	4.2	...	4.5
20	/	3.3	...	3.6
25	/	2.6	...	2.9
30	/	2.1	...	2.3
35	/	1.7	...	1.9

64 - 19

64-51 ... Expansion Valve

Inlet pressure	bar	14
Outlet pressure	bar	1.8
Leak test with leak detector at pressure of	bar	1 ... 2

HEATER AND AIR CONDITIONER		3 Series E 30	6 Series E 24
E4 - 20			
E4 53 ... Safety Switch (Single Switch — High Pressure Pressostat)			
Testing voltage	V	13 ± 0,26	
Switching-off pressure (with dropping pressure)	bar	25,2 ... 27,7	
Switching-on pressure (with rising pressure)	bar	20,0 ... 22,5	
Operating pressure	bar	0,004 ... 20	
E4 53 ... Safety Switch (Low Pressure Pressostat)			
Testing voltage	V	13 ± 0,26	
Switching-off pressure (with dropping pressure)	bar	1,72 ... 2,22	
Switching-on pressure (with rising pressure)	bar	2,0 ... 2,4	
Operating pressure	bar	0,004 ... 20	